

**APPENDIX D:  
AIR QUALITY AND GREENHOUSE GAS EMISSIONS DATA**

.....



## EXISTING STATE GHG REGULATIONS

### State Regulations

Current State of California guidance and goals for reductions in GHG emissions are generally embodied in Executive Order S-03-05), Assembly Bill 32 (AB 32), Senate Bill 32 (SB 32), Executive Order B-30-15, and Senate Bill 375 (SB 375). These are summarized as follows:

#### EXECUTIVE ORDER S-03-05

Executive Order S-03-05, signed June 1, 2005, set the following GHG reduction targets for the state:

- 2000 levels by 2010.
- 1990 levels by 2020.
- 80 percent below 1990 levels by 2050.

#### ASSEMBLY BILL 32

Also known as the Global Warming Solutions Act (2006), AB 32 was signed August 31, 2006, in order to reduce California's contribution of GHG emissions. AB 32 follows the 2020 tier of emissions reduction targets established in Executive Order S-03-05. Under AB 32, California Air Resources Board (CARB) prepared the 2008 Climate Change Scoping Plan, the 2014 Climate Change Scoping Plan, and the 2017 Climate Change Scoping Plan, which is discussed below.

#### CARB 2008 Scoping Plan

The 2008 Scoping Plan, adopted by CARB on December 11, 2008, identified that GHG emissions in California are anticipated to be approximately 596 MMTCO<sub>2e</sub> in 2020. In December 2007, CARB approved a 2020 emissions limit of 427 MMTCO<sub>2e</sub> (471 million tons) for the state. In order to effectively implement the emissions cap, AB 32 directed CARB to establish a mandatory reporting system to track and monitor GHG emissions levels for large stationary sources that generate more than 25,000 MTCO<sub>2e</sub> per year, prepare a plan demonstrating how the 2020 deadline can be met, and develop appropriate regulations and programs to implement the plan by 2012.

#### First Update to the Scoping Plan

CARB completed a five-year update to the 2008 Scoping Plan, as required by AB 32. The First Update to the Scoping Plan, adopted at the May 22, 2014, board hearing, highlights California's progress toward meeting the near-term 2020 GHG emission reduction goals defined in the 2008 Scoping Plan. As part of the update, CARB recalculated the 1990 GHG emission levels with the updated AR4 GWPs, and the 427 MMTCO<sub>2e</sub>

1990 emissions level and 2020 GHG emissions limit, established in response to AB 32, are slightly higher at 431 MMTCO<sub>2e</sub>.<sup>1</sup>

As identified in the Update to the Scoping Plan, California is on track to meeting the goals of AB 32. However, the update also addresses the State's longer-term GHG goals in a post-2020 element. The post-2020 element provides a high-level view of a long-term strategy for meeting the 2050 GHG goals, including a recommendation for the State to adopt a midterm target. According to the Update to the Scoping Plan, local government reduction targets should chart a reduction trajectory that is consistent with or exceeds the trajectory created by statewide goals.<sup>2</sup> CARB identified that reducing emissions to 80 percent below 1990 levels will require a fundamental shift to efficient, clean energy in every sector of the economy. Progressing toward California's 2050 climate targets will require significant acceleration of GHG reduction rates. Emissions from 2020 to 2050 will have to decline several times faster than the rate needed to reach the 2020 emissions limit.<sup>3</sup>

### **EXECUTIVE ORDER B-30-15**

Executive Order B-30-15, signed April 29, 2015, sets a goal of reducing GHG emissions within the State to 40 percent of 1990 levels by year 2030. Executive Order B-30-15 also directs CARB to update the Scoping Plan to quantify the 2030 GHG reduction goal for the State and requires State agencies to implement measures to meet the interim 2030 goal as well as the long-term goal for 2050 in Executive Order S-03-05. It also requires the Natural Resources Agency to conduct triennial updates of the California adaption strategy, Safeguarding California, in order to ensure climate change is accounted for in State planning and investment decisions.

### **SENATE BILL 32 AND ASSEMBLY BILL 197**

In September 2016, SB 32 and AB 197 were signed into law, making the Executive Order goal for year 2030 into a statewide mandated legislative target. AB 197 established a joint legislative committee on climate change policies and requires the CARB to prioritize direct emissions reductions rather than the market-based cap-and-trade program for large stationary, mobile, and other sources.

### **2017 Climate Change Scoping Plan Update**

Executive Order B-30-15 and SB 32 required CARB to prepare another update to the Scoping Plan to address the 2030 target for the state. On December 14, 2017, CARB adopted the 2017 Climate Change Scoping Plan Update (2017 Scoping Plan) to address the 2030 target for the State. The 2017 Scoping Plan establishes a new emissions limit of 260 MMTCO<sub>2e</sub> for the year 2030, which corresponds to a 40 percent decrease in 1990 levels by 2030.<sup>4</sup>

California's climate strategy will require contributions from all sectors of the economy, including enhanced focus on zero- and near-zero emission vehicle technologies; continued investment in renewables, such as

---

<sup>1</sup> California Air Resources Board, 2014, May 15. First Update to the Climate Change Scoping Plan: Building on the Framework, Pursuant to AB 32, The California Global Warming Solutions Act of 2006.

<sup>2</sup> California Air Resources Board, 2014, May 15. First Update to the Climate Change Scoping Plan: Building on the Framework, Pursuant to AB 32, The California Global Warming Solutions Act of 2006.

<sup>3</sup> California Air Resources Board, 2014, May 15. First Update to the Climate Change Scoping Plan: Building on the Framework, Pursuant to AB 32, The California Global Warming Solutions Act of 2006.

<sup>4</sup> California Air Resources Board, 2017, California's 2017 Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Target, [https://www.arb.ca.gov/cc/scopingplan/2030sp\\_pp\\_final.pdf](https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf), accessed on March 18, 2019.

solar roofs, wind, and other types of distributed generation; greater use of low carbon fuels; integrated land conservation and development strategies; coordinated efforts to reduce emissions of short-lived climate pollutants (i.e., methane, black carbon, and fluorinated gases); and an increased focus on integrated land use planning to support livable, transit-connected communities and conservation of agricultural and other lands. Requirements for GHG reductions at stationary sources complement local air pollution control efforts by the local air districts to tighten criteria air pollutants and toxic air contaminants (TACs) emissions limits on a broad spectrum of industrial sources. Major elements of the 2017 Scoping Plan framework include:

- Implementing and/or increasing the standards of the Mobile Source Strategy, which include increasing zero emission vehicle buses and trucks.
- Low Carbon Fuel Standards, with an increased stringency (18 percent by 2030).
- Implementation of SB 350, which expands the Renewables Portfolio Standard (RPS) to 50 percent RPS and doubles energy efficiency savings by 2030.
- California Sustainable Freight Action Plan, which improves freight system efficiency, utilizes near-zero emissions technology, and deployment of zero emission vehicle trucks.
- Implementing the proposed Short-Lived Climate Pollutant Strategy, which focuses on reducing methane and hydrofluorocarbon emissions by 40 percent and anthropogenic black carbon emissions by 50 percent by year 2030.
- Continued implementation of SB 375.
- Post-2020 Cap-and-Trade Program that includes declining caps.
- Development of a Natural and Working Lands Action Plan to secure California’s land base as a net carbon sink.

In addition to the statewide strategies listed above, the 2017 Scoping Plan also identified local governments as essential partners in achieving the State’s long-term GHG reduction goals and identified local actions to reduce GHG emissions. As part of the recommended actions, CARB recommends statewide targets of no more than 6 MTCO<sub>2e</sub> or less per capita by 2030 and 2 MTCO<sub>2e</sub> or less per capita by 2050. CARB recommends that local governments evaluate and adopt robust and quantitative locally-appropriate goals that align with the statewide per capita targets and the State’s sustainable development objectives and develop plans to achieve the local goals. The statewide per capita goals were developed by applying the percent reductions necessary to reach the 2030 and 2050 climate goals (i.e., 40 percent and 80 percent, respectively) to the State’s 1990 emissions limit established under AB 32. For CEQA projects, CARB states that lead agencies have the discretion to develop evidenced-based numeric thresholds (mass emissions, per capita, or per service population)—consistent with the Scoping Plan and the State’s long-term GHG goals. To the degree a project relies on GHG mitigation measures, CARB recommends that lead agencies prioritize on-site design features that reduce emissions, especially from vehicle miles travelled (VMT), and direct investments in GHG reductions within the project’s region that contribute potential air quality, health, and economic co-benefits. Where further project design or regional investments are infeasible or not proven to be effective, CARB recommends mitigating potential GHG impacts through purchasing and retiring carbon credits.

The Scoping Plan scenario is set against what is called the business-as-usual (BAU) yardstick—that is, what the GHG emissions would look like if the State did nothing at all beyond the existing policies that are required and already in place to achieve the 2020 limit, as shown in Table 1. It includes the existing renewables requirements, advanced clean cars, the “10 percent” Low Carbon Fuel Standard, and the SB 375 program for more vibrant communities, among others. However, it does not include a range of new

policies or measures that have been developed or put into statute over the past two years. Also shown in the table, the known commitments are expected to result in emissions that are 60 MMTCO<sub>2</sub>e above the target in 2030. If the estimated GHG reductions from the known commitments are not realized due to delays in implementation or technology deployment, the post-2020 Cap-and-Trade Program would deliver the additional GHG reductions in the sectors it covers to ensure the 2030 target is achieved.

**TABLE 1 2017 CLIMATE CHANGE SCOPING PLAN EMISSIONS REDUCTIONS GAP TO ACHIEVE THE 2030 GHG TARGET**

<b>Modeling Scenario</b>	<b>2030 GHG Emissions MMTCO<sub>2</sub>e</b>
Reference Scenario (Business-as-Usual)	389
With Known Commitments	320
2030 GHG Target	<b>260</b>
Gap to 2030 Target with Known Commitments	<b>60</b>

Source: California Air Resources Board, 2017. California's 2017 Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Target, [https://www.arb.ca.gov/cc/scopingplan/2030sp\\_pp\\_final.pdf](https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf), accessed on March 18, 2019.

Table 2 provides estimated GHG emissions by sector, compared to 1990 levels, and the range of GHG emissions for each sector estimated for 2030.

**TABLE 2 2017 CLIMATE CHANGE SCOPING PLAN EMISSIONS BY SECTOR TO ACHIEVE THE 2030 GHG TARGET**

<b>Scoping Plan Sector</b>	<b>1990 MMTCO<sub>2</sub>e</b>	<b>2030 Proposed Plan Ranges MMTCO<sub>2</sub>e</b>	<b>% Change from 1990</b>
Agricultural	26	24-25	-8% to -4%
Residential and Commercial	44	38-40	-14% to -9%
Electric Power	108	30-53	-72% to -51%
High GWP	3	8-11	267% to 367%
Industrial	98	83-90	-15% to -8%
Recycling and Waste	7	8-9	14% to 29%
Transportation (including TCU)	152	103-111	-32% to -27%
Net Sink <sup>a</sup>	-7	TBD	TBD
Sub Total	431	294-339	-32% to -21%
Cap-and-Trade Program	NA	34-79	NA
<b>Total</b>	<b>431</b>	<b>260</b>	<b>-40%</b>

Notes: TCU = Transportation, Communications, and Utilities; TBD = To Be Determined.

a. Work is underway through 2017 to estimate the range of potential sequestration benefits from the natural and working lands sector.

Source: California Air Resources Board. 2017, California's 2017 Climate Change Scoping Plan: The Strategy for Achieving California's 2030 Greenhouse Gas Target. [https://www.arb.ca.gov/cc/scopingplan/2030sp\\_pp\\_final.pdf](https://www.arb.ca.gov/cc/scopingplan/2030sp_pp_final.pdf), accessed on March 18, 2019.

## **SENATE BILL 375**

In 2008, SB 375, the Sustainable Communities and Climate Protection Act, was adopted to connect the GHG emissions reductions targets established in the 2008 Scoping Plan for the transportation sector to local land use decisions that affect travel behavior. Its intent is to reduce GHG emissions from light-duty trucks and automobiles (excludes emissions associated with goods movement) by aligning regional long-range transportation plans, investments, and housing allocations to local land use planning to reduce VMT and vehicle trips. Specifically, SB 375 required CARB to establish GHG emissions reduction targets for each of the 18 metropolitan planning organizations (MPOs). The Metropolitan Transportation Commission (MTC) is the MPO for the nine-county San Francisco Bay Area region. Pursuant to the recommendations of the Regional Transportation Advisory Committee (RTAC), CARB adopted per capita reduction targets for each of the MPOs rather than a total magnitude reduction target.

### **2017 Update to the SB 375 Targets**

CARB is required to update the targets for the MPOs every eight years. CARB adopted revised SB 375 targets for the MPOs in March 2018.<sup>5</sup> The updated targets become effective on October 1, 2018. The targets consider the need to further reduce VMT, as identified in the 2017 Scoping Plan Update (for SB 32), while balancing the need for additional and more flexible revenue sources to incentivize positive planning and action toward sustainable communities. Like the 2010 targets, the updated SB 375 targets are in units of percent per capita reduction in GHG emissions from automobiles and light trucks relative to 2005; this excludes reductions anticipated from implementation of state technology and fuels strategies, and any potential future state strategies, such as statewide road user pricing.

The proposed targets call for greater per-capita GHG emission reductions from SB 375 than are currently in place, which for 2035 translate into proposed targets that either match or exceed the emission reduction levels in the MPOs' currently adopted SCS to achieve the SB 375 targets. For next SCS update, CARB's updated targets for the MTC/ABAG region are a 10 percent per capita GHG reduction in 2020 from 2005 levels (compared to 7 percent under the 2010 target) and a 19 percent per capita GHG reduction in 2035 from 2005 levels (compared to the 2010 target of 15 percent). CARB foresees that the additional GHG emissions reductions in 2035 may be achieved from land use changes, transportation investment, and technology strategies.<sup>6</sup>

## **OTHER STATE REGULATIONS THAT AFFECT GHGS**

### **Transportation Sector**

#### **Assembly Bill 1493**

Also known as Pavley I, AB 1493 is a clean-car standard that reduces GHG emissions from new passenger vehicles (light-duty auto to medium-duty vehicles) from 2009 through 2016. It reduced GHG emissions from new passenger vehicles by 30 percent by 2016. California implemented the Pavley I standards through a waiver granted to California by the EPA. In 2012, the EPA issued a Final Rulemaking that sets even more stringent fuel economy and GHG emissions standards for model year 2017 through 2025 light-duty vehicles (see also the discussion on the update to the CAFE standards under the heading for Federal Regulations, above). In January 2012, CARB approved the Advanced Clean Cars program (formerly known

---

<sup>5</sup> California Air Resources Board, 2018, Updated Final Staff Report: Proposed Update to the SB 375 Greenhouse Gas Emissions Reduction Targets.

<sup>6</sup> California Air Resources Board, 2018, Updated Final Staff Report: Proposed Update to the SB 375 Greenhouse Gas Emissions Reduction Targets.

as Pavley II) for model years 2017 through 2025. This program combines the control of smog, soot, and global warming gases and requirements for greater numbers of zero-emission vehicles into a single package of standards. Under California’s Advanced Clean Car program, by 2025, new automobiles will emit 34 percent fewer global warming gases and 75 percent fewer smog-forming emissions.<sup>7</sup>

#### **Executive Order S-01-07**

On January 18, 2007, the State set a new Low Carbon Fuel Standard for transportation fuels sold in California. Executive Order S-01-07 sets a declining standard for GHG emissions measured in carbon dioxide equivalent gram per unit of fuel energy sold in California. The Low Carbon Fuel Standard required a reduction of 2.5 percent in the carbon intensity of California’s transportation fuels by 2015 and a reduction of at least 10 percent by 2020. The Low Carbon Fuel Standard applies to refiners, blenders, producers, and importers of transportation fuels and would use market-based mechanisms to allow these providers to choose how they reduce emissions during the “fuel cycle,” using the most economically feasible methods.

#### **Executive Order B-16-2012**

Signed on March 23, 2012, the State directed that CARB, the California Energy Commission, the Public Utilities Commission, and other relevant agencies work with the Plug-in Electric Vehicle Collaborative and the California Fuel Cell Partnership to establish benchmarks to accommodate zero-emissions vehicles in major metropolitan areas, including infrastructure to support them (e.g., electric vehicle charging stations). The executive order also directs the number of zero-emission vehicles in California’s state vehicle fleet to increase through the normal course of fleet replacement so that at least 10 percent of fleet purchases of light-duty vehicles are zero-emission by 2015 and at least 25 percent by 2020. Finally, the executive order sets a target of reducing GHG emissions from the transportation sector 80 percent below 1990 levels.

### **Energy and Renewable Energy**

#### **Senate Bills 1078, 107, and X1-2, and Executive Order S-14-08**

A major component of California’s Renewable Energy Program is the renewable portfolio standard established under Senate Bill 1078 and 107. Executive Order S-14-08 was signed in November 2008, which expanded the State’s Renewable Energy Standard to 33 percent renewable power by 2020. This standard was adopted by the legislature in 2011 (SB X1-2). The increase in renewable sources for electricity production will decrease indirect GHG emissions from development projects because electricity production from renewable sources is generally considered carbon neutral.

#### **Senate Bill 350**

Signed in September 2015, SB 350 establishes tiered increases to the renewable portfolio standard of 40 percent by 2024, 45 percent by 2027, and 50 percent by 2030. SB 350 seeks to double the energy efficiency savings in electricity and natural gas through energy efficiency and conservation measures.

#### **Executive Order B-55-18 and SB 100**

SB 100 and Executive Order B-55-18 were signed into law on September 10, 2018. Under the existing RPS, 25 percent of retail sales are required to be from renewable sources by December 31, 2016, 33 percent by December 31, 2020, 40 percent by December 31, 2024, 45 percent by December 31, 2027, and 50 percent

---

<sup>7</sup> See also the discussion on the update to the CAFE standards under Federal Laws, above. In January 2012, CARB approved the Advanced Clean Cars program (formerly known as Pavley II) for model years 2017 through 2025. The program combines the control of smog, soot and global warming gases and requirements for greater numbers of zero-emission vehicles into a single package of standards. Under California’s Advanced Clean Car program, by 2025, new automobiles will emit 34 percent fewer global warming gases and 75 percent fewer smog-forming emissions.



by December 31, 2030. SB 100 raises California’s RPS requirement to 50 percent renewable resources target by December 31, 2026, and to achieve a 60 percent target by December 31, 2030. SB 100 also requires that retail sellers and local publicly owned electric utilities procure a minimum quantity of electricity products from eligible renewable energy resources so that the total kilowatt hours of those products sold to their retail end-use customers achieve 44 percent of retail sales by December 31, 2024, 52 percent by December 31, 2027, and 60 percent by December 31, 2030.

In addition to targets under AB 32 and SB32, Executive Order B-55-18 establishes a carbon neutrality goal for the state of California by 2045; and sets a goal to maintain net negative emissions thereafter. The Executive Order directs the California Natural Resources Agency, CalEPA, the Department of Food and Agriculture, and CARB to include sequestration targets in the Natural and Working Lands Climate Change Implementation Plan consistent with the carbon neutrality goal.

### **California Building Code: Building Energy Efficiency Standards**

Energy conservation standards for new residential and non-residential buildings were adopted in June 1977 and most recently revised in 2016 (Title 24, Part 6, of the California Code of Regulations). Title 24 requires the design of building shells and building components to conserve energy. The standards are updated periodically to allow for consideration and possible incorporation of new energy efficiency technologies and methods. The 2019 Building Energy Efficiency Standards, which were adopted on May 9, 2018, went into effect January 1, 2020.<sup>8</sup> The 2019 standards move toward cutting energy use in new homes by more than 50 percent and will require installation of solar photovoltaic systems for single-family homes and multifamily buildings of three stories and less. Four key areas the 2019 standards focus on are 1) smart residential photovoltaic systems; 2) updated thermal envelope standards (preventing heat transfer from the interior to exterior and vice versa); 3) residential and nonresidential ventilation requirements; and 4) nonresidential lighting requirements.<sup>9</sup> Under the 2019 standards, nonresidential buildings will be 30 percent more energy efficient compared to the 2016 standards, and single-family homes will be 7 percent more energy efficient. When accounting for the electricity generated by the solar photovoltaic system, single-family homes would use 53 percent less energy than homes built to the 2016 standards.<sup>10</sup>

### **California Building Code: CALGreen**

On July 17, 2008, California Green Building Standards Code (24 California Code of Regulations, Part 11, known as “CALGreen”) were adopted as part of the California Building Standards Code. CALGreen established planning and design standards for sustainable site development, energy efficiency (in excess of the California Energy Code requirements), water conservation, material conservation, and internal air contaminants.<sup>11</sup> The mandatory provisions of the 2016 CalGreen building standards became effective on January 1, 2017. The CEC adopted the 2019 CALGreen on May 9, 2018, and it becomes effective January 1, 2020.

---

<sup>8</sup> California Energy Commission, 2015, 2016 Building Energy and Efficiency Standards Frequently Asked Questions, [http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016\\_Building\\_Energy\\_Efficiency\\_Standards\\_FAQ.pdf](http://www.energy.ca.gov/title24/2016standards/rulemaking/documents/2016_Building_Energy_Efficiency_Standards_FAQ.pdf), accessed on March 18, 2019.

<sup>9</sup> California Energy Commission, 2018, Energy Commission Adopts Standards Requiring Solar Systems for New Homes, First in Nation. News Release.

<sup>10</sup> California Energy Commission, 2018, 2019 Building Energy and Efficiency Standards Frequently Asked Questions. [http://www.energy.ca.gov/title24/2019standards/documents/2018\\_Title\\_24\\_2019\\_Building\\_Standards\\_FAQ.pdf](http://www.energy.ca.gov/title24/2019standards/documents/2018_Title_24_2019_Building_Standards_FAQ.pdf), accessed on March 18, 2019.

<sup>11</sup> The green building standards became mandatory in the 2010 edition of the code.

## **2006 Appliance Efficiency Regulations**

Adopted by the California Energy Commission on October 11, 2006, the 2006 Appliance Efficiency Regulations (Title 20, California Code of Regulations, Sections 1601 through 1608) were approved by the California Office of Administrative Law on December 14, 2006. The regulations include standards for both federally regulated appliances and non–federally regulated appliances. Though these regulations are now often viewed as “business-as-usual,” they exceed the standards imposed by all other states and they reduce GHG emissions by reducing energy demand.

## **Solid Waste Regulations**

### **AB 939**

Management of solid waste processing would contribute to reducing GHG emissions. Through operations such as source reduction, recycling, and composting, less waste would be produced and less energy would be consumed to process waste materials, thereby reducing GHG emissions. California’s Integrated Waste Management Act of 1989 (AB 939, Public Resources Code 40050 et seq.) set a requirement for cities and counties throughout the state to divert 50 percent of all solid waste from landfills by January 1, 2000, through source reduction, recycling, and composting. In 2008, the requirements were modified to reflect a per capita requirement rather than tonnage. To help achieve this, the act requires that each city and county prepare and submit a source reduction and recycling element. AB 939 also established the goal for all California counties to provide at least 15 years of ongoing landfill capacity.

### **AB 341**

AB 341 (Chapter 476, Statutes of 2011) increased the statewide goal for waste diversion to 75 percent by 2020 and requires recycling of waste from commercial and multifamily residential land uses.

### **AB 1327**

The California Solid Waste Reuse and Recycling Access Act (AB 1327, California Public Resources Code Sections 42900 et seq.) requires areas to be set aside for collecting and loading recyclable materials in development projects. The act required the California Integrated Waste Management Board to develop a model ordinance for adoption by any local agency requiring adequate areas for collection and loading of recyclable materials as part of development projects. Local agencies are required to adopt the model or an ordinance of their own. Section 5.408 of the CALGreen also requires that at least 50 percent of the nonhazardous construction and demolition waste from nonresidential construction operations be recycled and/or salvaged for reuse.

### **AB 1826**

AB 1826, signed on October of 2014, requires businesses to recycle their organic waste on and after April 1, 2016, depending on the amount of waste they generate per week. This law also requires that on and after January 1, 2016, local jurisdictions implement an organic waste recycling program to divert organic waste generated by businesses, including multifamily residential dwellings that consist of five or more units. Organic waste means food waste, green waste, landscape and pruning waste, nonhazardous wood waste, and food-soiled paper waste that is mixed in with food waste.

## **Water Efficiency Regulations**

### **SBX7-7**

Water conservation would indirectly contribute to reducing greenhouse gases. As less water is used, fewer resources will be used to source, distribute, and treat the water. The 20x2020 Water Conservation Plan

was issued by the Department of Water Resources (DWR) in 2010 pursuant to Senate Bill 7, which was adopted during the 7th Extraordinary Session of 2009 to 2010 and therefore dubbed “SBX7-7.” SBX7-7 mandated urban water conservation and authorized the DWR to prepare a plan implementing urban water conservation requirements (20x2020 Water Conservation Plan). In addition, it required agricultural water providers to prepare agricultural water management plans, measure water deliveries to customers, and implement other efficiency measures. SBX7-7 requires urban water providers to adopt a water conservation target of 20 percent reduction in urban per capita water use by 2020 compared to 2005 baseline use.

#### **AB 1881**

The Water Conservation in Landscaping Act of 2006 (AB 1881) requires local agencies to adopt the updated DWR model ordinance or equivalent. AB 1881 also requires the Energy Commission, in consultation with the department, to adopt, by regulation, performance standards and labeling requirements for landscape irrigation equipment, including irrigation controllers, moisture sensors, emission devices, and valves to reduce the wasteful, uneconomic, inefficient, or unnecessary consumption of energy or water.

### **Short-Lived Climate Pollutants**

#### **Senate Bill 1383**

On September 19, 2016, SB 1383 was signed into law to supplement the GHG reduction strategies in the Scoping Plan to consider short-lived climate pollutants, including black carbon and CH<sub>4</sub>. Black carbon is the light-absorbing component of fine particulate matter produced during incomplete combustion of fuels. SB 1383 required the State board, to approve and begin implementing the comprehensive strategy to reduce emissions of short-lived climate pollutants to achieve a reduction in methane by 40 percent, hydrofluorocarbon gases by 40 percent, and anthropogenic black carbon by 50 percent below 2013 levels by 2030. The bill also established targets for reducing organic waste in landfills. On March 14, 2017, CARB adopted the Final Proposed Short-Lived Climate Pollutant Strategy, which identifies the State’s approach to reducing anthropogenic and biogenic sources of short-lived climate pollutants. Anthropogenic sources of black carbon include on- and off-road transportation, residential wood burning, fuel combustion (charbroiling), and industrial processes. According to CARB, ambient levels of black carbon in California are 90 percent lower than in the early 1960s, despite the tripling of diesel fuel use.<sup>12</sup> In-use on-road rules are expected to reduce black carbon emissions from on-road sources by 80 percent between 2000 and 2020.

---

<sup>12</sup> California Air Resources Board, 2017, Short-Lived Climate Pollutant Reduction Strategy, [https://www.arb.ca.gov/cc/shortlived/meetings/03142017/final\\_slcp\\_report.pdf](https://www.arb.ca.gov/cc/shortlived/meetings/03142017/final_slcp_report.pdf), accessed on March 18, 2019.

# San Rafael Activity Data

## San Rafael GHG Emissions Inventory 2016 Project Activity Data

Source:

Data provided by O'Rourke & Associate. Activity data used for the Marin Climate & Energy Partnership. 2018, February. City of San Rafael Community Greenhouse Gas Emissions Inventory for Year 2015. As noted in the inventory, 1 transmission and distribution losses are included in reported emissions from electricity (4.23% in 2016).

2 Marin Climate & Energy Partnership. 2019, April 23. City of San Rafael Climate Change Action Plan 2030.

Sector	Subsector	Activity Data Units	2016 Activity Data	Emissions Factor	Emissions Factor Unit	2016 Emissions MTCO <sub>2e</sub>	Growth Factor
<b>Energy</b>							
<b>Electricity<sup>1, 2</sup></b>							
		MTCO <sub>2e</sub>					
	Electricity - PG&E + MCE	kWh	332,512,237	0.0002008	MTCO <sub>2e</sub> /Kwh	66,784	
	Residential	kWh	118,031,218				Housing Units
	NonResidential	kWh	214,481,019				Employment
	PG&E			0.0001341	MTCO <sub>2e</sub> /Kwh		
	MCE Light Green			0.0001302	MTCO <sub>2e</sub> /Kwh		
	MCE Deep Green			0.0000000	MTCO <sub>2e</sub> /Kwh		
	Other Direct Access			0.0002404	MTCO <sub>2e</sub> /Kwh		
<b>Natural Gas<sup>1, 2</sup></b>							
	PG&E Gas	therms	15,155,231	0.00416	MT/therm	63,067	
	Residential Natural Gas	therms	9,467,604				Housing Units
	Non-Residential Natural Gas	therms	5,687,627				Employment
<b>Transportation</b>							
	Vehicle Miles Traveled	VMT				238,943	VMT Growth
<b>Offroad Vehicles and Equipment</b>							
OFFROAD	Construction, Lawn & Garden, Light Commercial	MTCO <sub>2e</sub>				3,613	See Offroad
<b>Solid Waste/Landfills</b>							
	Total Solid Waste Disposal	Tons	57,000			14,933	Service Population
<b>Water and Wastewater</b>							
<b>Water Consumption</b>							
	Annual Water Use	million gallons	6,915	0.09154	MTCO <sub>2e</sub> /MG	633	Service Population
		Gallons Per Capita	114				
<b>Wastewater Treatment</b>							
	Wastewater Treatment	million gallons			Kwh/mgallons	978	Service Population
<b>TOTAL COMMUNITY</b>						<b>388,951</b>	

## Land Use Statistics - San Rafael + SOI

	GHG Inventory <sup>1</sup>	CEQA Baseline	GP Horizon	Change	2040 Growth Factor from Baseline
	2016	2019	2040	2040-2019	
Population	60,661	75,751	84,661	8,910	0.12
City	60,661	61,230	69,240	8,010	0.13
SOI		14,521	15,421	900	0.06
Downtown Precise Plan		2,315	5,885	3,570	1.54
Downtown as a % of City		4%	8%	45%	11.79
Household	23,051	28,132	32,382	4,250	0.15
City	23,051	22,961	26,821	3,860	0.17
SOI		5,171	5,561	390	0.08
Downtown Precise Plan		1,496	3,596	2,100	1.40
Downtown as a % of City		7%	13%	54%	8.35
Dwelling Units <sup>2</sup>	23,885	29,529	33,989	4,460	0.15
City	23,885	24,109	28,159	4,050	0.17
SOI		5,420	5,830	410	0.08
Downtown Precise Plan		1,571	3,771	2,200	1.40
Downtown as a % of City		7%	13%	54%	8.34
Employment	41,918	44,200	48,315	4,115	0.09
City <sup>3</sup>	41,918	42,050	46,100	4,050	0.10
SOI		2,150	2,215	65	0.03
Downtown Precise Plan		6,700	8,720	2,020	0.30
Downtown as a % of City		16%	19%	50%	3.13
Service Population	102,579	119,951	132,976	13,025	0.11
City	102,579	103,280	115,340	12,060	0.12
SOI	0	16,671	17,636	965	0.06
Downtown Precise Plan		9,015	14,605	5,590	0.62
Downtown as a % of City		9%	13%	46%	5.31

### Notes

Marin Climate & Energy Partnership. 2018, February. City of San Rafael Community Greenhouse Gas Emissions Inventory for 1 Year 2015.

<sup>2</sup> Dwelling units for year 2016 backcalculated based on population/unit ratio in 2019.

Employment in 2016 estimated based on the increase in employment between 2015 and 2020 estimated by ABAG. Association of Bay Area Governments (ABAG). 2019, May 1. Projections 2040 by Jurisdiction

<sup>3</sup> <https://data.bayareametro.gov/Demography/Projections-2040-by-Jurisdiction/grqz-amra>

# **San Rafael City + SOI Emissions**

## San Rafael Community GHG Emissions Inventory and Forecast

Category	GHG Emissions (MtCO <sub>2</sub> e/Year)											
	Existing (2019)				General Plan 2040				Net Change			
	City	SOI	TOTAL		City	SOI	TOTAL		City	SOI	TOTAL	
Building Electricity	67,142	7,589	74,731	12%	49,167	5,263	54,430	11%	-17,975	-2,326	-20,301	-27%
Building Natural Gas	63,511	10,154	73,666	12%	72,479	10,867	83,346	17%	8,967	713	9,680	13%
On-Road Transportation	375,518	46,644	422,162	71%	277,721	31,938	309,659	65%	-97,797	-14,706	-112,503	-27%
Off-Road Vehicles and Equipment	2,582	161	2,742	0.5%	2,807	172	2,979	1%	225	12	237	9%
Solid Waste/Landfills	19,632	3,169	22,801	4%	21,924	3,352	25,277	5%	2,292	183	2,476	11%
Water Use	1,170	277	1,447	0.2%	1,323	295	1,617	0.3%	153	17	170	12%
Wastewater Treatment	792	188	980	0.2%	896	200	1,095	0.2%	104	12	115	12%
<b>Total Community Emissions</b>	<b>530,347</b>	<b>68,182</b>	<b>598,529</b>	<b>100%</b>	<b>426,317</b>	<b>52,086</b>	<b>478,403</b>	<b>100%</b>	<b>-104,030</b>	<b>-16,095</b>	<b>-120,126</b>	<b>-20%</b>
Service Population (SP)	103,280	16,671	119,951		115,340	17,636	132,976		12,060	965	13,025	11%
MTCO <sub>2</sub> e/SP	5.1	4.1	5.0		3.7	3.0	3.6		-1.4	-1.1	-1.4	-28%
<b>Trajectory to EO S-03-05</b>			<b>359,117</b>				<b>478,403</b>		<b>0</b>	<b>0</b>	<b>119,286</b>	<b>33%</b>

Notes: Emissions may not total to 100 percent due to rounding. Based on GWPs in the IPCC Fifth Assessment Report (AR5).

The emissions inventory and forecast is based on activity data for the City. This emissions inventory methodology identifies GHG emissions produced within a jurisdiction and captures direct and indirect emissions generated by land uses in a community. The activity data methodology allows a direct comparison between a community's GHG emissions and that identified by CARB in the AB 32 and SB 32 inventory and forecast prepared for the scoping plan. Unlike a "consumption-based" GHG emissions inventory, an activity-based emissions inventory does not capture lifecycle emissions associated with consumptions of goods. While a consumption-based emissions inventory approach may document GHG emissions associated with the final demand (regardless of where they were generated), a consumption-based emissions inventory excludes emissions associated with products produced within the jurisdiction but consumed elsewhere. For these reasons, an activity-based emissions inventory was determined to be most applicable for determining significant impacts under CEQA.



## San Rafael Community Criteria Air Pollutant Emissions Inventory and Forec

### Sources

<sup>1</sup> Source: Fehr & Peers; EMFAC2017 PL Web database

<sup>2</sup> Source: Data provided by O'Rourke & Associate. Activity data used for the Marin Climate & Energy Partnership. 2018, February. City of San Rafael Community Greenhouse Gas Emissions Inventory for Year 2015.; CalEEMod User's Guide

<sup>3</sup> Source: OFFROAD 2017

<sup>4</sup> Source: CalEEMod User's Guide

### EXISTING

Phase	Existing (2019) Criteria Air Pollutant Emissions (pounds/day)			
	VOC	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>City</b>				
Transportation <sup>1</sup>	125	781	354	148
Energy <sup>2</sup>	45	385	31	31
Offroad Equipment <sup>3</sup>	78	104	16	13
Consumer Products <sup>4</sup>	932			
Subtotal	1,180	1,270	401	192
<b>SOI</b>				
Transportation <sup>1</sup>	15	97	44	18
Energy <sup>2</sup>	7	66	5	5
Offroad Equipment <sup>3</sup>	4	7	1	1
Consumer Products <sup>4</sup>	210			
Subtotal	237	169	50	24
<b>Total</b>				
Transportation <sup>1</sup>	140	878	398	166
Energy <sup>2</sup>	52	451	36	36
Offroad Equipment <sup>3</sup>	82	110	17	13
Consumer Products <sup>4</sup>	1,142			
Total	1,416	1,439	451	216
<b>Total Tons Per Year</b>				
Transportation <sup>1</sup>	24	152	69	29
Energy <sup>2</sup>	10	82	7	7
Offroad Equipment <sup>3</sup>	15	20	3	2
Consumer Products <sup>4</sup>	208			
Total	257	255	79	38

## San Rafael Community Criteria Air Pollutant Emissions Inventory and Forec

### EXISTING WITH 2040 EMISSION RATES

Phase	Existing Criteria Air Pollutant Emissions (pounds/day)			
	VOC	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>

#### City

Transportation <sup>1</sup>	92	304	357	145
Energy <sup>2</sup>	45	385	31	31
Offroad Equipment <sup>3</sup>	78	104	16	13
Consumer Products <sup>4</sup>	932			
Subtotal	1,147	793	405	189

#### SOI

Transportation <sup>1</sup>	11	38	44	18
Energy <sup>2</sup>	7	66	5	5
Offroad Equipment <sup>3</sup>	4	7	1	1
Consumer Products <sup>4</sup>	210			
Subtotal	233	110	50	24

#### TOTAL

Transportation <sup>1</sup>	104	341	402	163
Energy <sup>2</sup>	52	451	36	36
Area <sup>3</sup>	82	110	17	13
Consumer Products <sup>4</sup>	1,142			
Total	1,380	902	455	213

#### Total Tons Per Year

Transportation <sup>1</sup>	18	59	70	28
Energy <sup>2</sup>	10	82	7	7
Offroad Equipment <sup>3</sup>	15	20	3	2
Consumer Products <sup>4</sup>	208			
Total	251	162	79	37

## San Rafael Community Criteria Air Pollutant Emissions Inventory and Forec

### 2040 Project

Phase	Project (2040) Criteria Air Pollutant Emissions (pounds/day)			
	VOC	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>

#### City

Transportation <sup>1</sup>	96	317	372	151
Energy <sup>2</sup>	51	440	36	36
Offroad Equipment <sup>3</sup>	85	113	18	14
Consumer Products <sup>4</sup>	1,159			
Subtotal	1,391	869	426	201

#### SOI

Transportation <sup>1</sup>	11	36	43	17
Energy <sup>2</sup>	8	70	5	5
Offroad Equipment <sup>3</sup>	5	7	1	1
Consumer Products <sup>4</sup>	233			
Subtotal	256	114	49	24

#### TOTAL

Transportation <sup>1</sup>	107	353	415	169
Energy <sup>2</sup>	59	510	41	41
Offroad Equipment <sup>3</sup>	89	120	19	15
Consumer Products <sup>4</sup>	1,391	0	0	0
Total	<b>1,647</b>	<b>983</b>	<b>475</b>	<b>224</b>

#### Total Tons Per Year

Transportation <sup>1</sup>	19	61	72	29
Energy <sup>2</sup>	11	93	7	7
Offroad Equipment <sup>3</sup>	16	22	3	3
Consumer Products <sup>4</sup>	254			
Total	<b>300</b>	<b>176</b>	<b>83</b>	<b>39</b>

## San Rafael Community Criteria Air Pollutant Emissions Inventory and Forec

### NET CHANGE (2040 Emission Rates)

Phase	Net Change Criteria Air Pollutant Emissions (pounds/day)			
	VOC	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
<b>City</b>				
Transportation <sup>1</sup>	4	13	15	6
Energy <sup>2</sup>	6	54	4	4
Offroad Equipment <sup>3</sup>	7	9	1	1
Consumer Products <sup>4</sup>	227	0	0	0
Subtotal	244	76	21	12
<b>SOI</b>				
Transportation <sup>1</sup>	0	-1	-2	-1
Energy <sup>2</sup>	1	5	0	0
Offroad Equipment <sup>3</sup>	0	0	0	0
Consumer Products <sup>4</sup>	23	0	0	0
Subtotal	23	4	-1	0
<b>TOTAL</b>				
Transportation <sup>1</sup>	4	12	14	6
Energy <sup>2</sup>	7	59	5	5
Offroad Equipment <sup>3</sup>	7	9	1	1
Consumer Products <sup>4</sup>	250	0	0	0
Total	268	80	20	11
BAAQMD Threshold	54	54	82	54
Exceeds Threshold	Yes	Yes	No	No
<b>Total Tons Per Year</b>				
Transportation <sup>1</sup>	1	2	2	1
Energy <sup>2</sup>	1	11	1	1
Offroad Equipment <sup>3</sup>	1	2	0	0
Consumer Products <sup>4</sup>	46	0	0	0
Total	49	15	4	2
BAAQMD Threshold	10	10	15	10
Exceeds Threshold	Yes	Yes	No	No

## San Rafael Community Criteria Air Pollutant Emissions Inventory and Forec

### NET CHANGE (from Existing)

Phase	Net Change (2040-2016) Criteria Air Pollutant Emissions (pounds/day)			
	VOC	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>

#### CITY

Transportation <sup>1</sup>	-28	-464	19	3
Energy <sup>2</sup>	6	54	4	4
Offroad Equipment <sup>3</sup>	7	9	1	1
Consumer Products <sup>4</sup>	227	0	0	0
Subtotal	212	-401	25	9

#### SOI

Transportation <sup>1</sup>	-4	-61	-1	-1
Energy <sup>2</sup>	1	5	0	0
Offroad Equipment <sup>3</sup>	0	0	0	0
Consumer Products <sup>4</sup>	23	0	0	0
Subtotal	19	-56	-1	-1

#### TOTAL

Transportation <sup>1</sup>	-33	-525	18	2
Energy <sup>2</sup>	7	59	5	5
Offroad Equipment <sup>3</sup>	7	9	1	1
Consumer Products <sup>4</sup>	250	0	0	0
Total	231	-456	24	8

BAAQMD Threshold	54	54	82	54
------------------	----	----	----	----

Exceeds Threshold	Yes	No	No	No
-------------------	-----	----	----	----

#### Total Tons Per Year

Transportation <sup>1</sup>	-6	-91	3	0
Energy <sup>2</sup>	1	11	1	1
Offroad Equipment <sup>3</sup>	1	2	0	0
Consumer Products <sup>4</sup>	46	0	0	0
Total	42	-79	4	1

BAAQMD Threshold	10	10	15	10
------------------	----	----	----	----

Exceeds Threshold	Yes	No	No	No
-------------------	-----	----	----	----

Table 4.3-9 Comparison of the Change in Population and VMT in the City of San Rafael

Category	Baseline	2040 Without Project	2040 With Project	Net Change from Baseline	Percent Increase from Baseline	Net Change Between With and Without Project	Percent Change Between With and Without Project
<b>City</b>							
Population <sup>a</sup>	61,230	NA	69,240	8,010	13%	NA	NA
Employment	42,050	NA	46,100	4,050	10%	NA	NA
Service Population (SP)	103,280	111,825	115,340	12,060	12%	3,515	3%
VMT per Day <sup>c</sup>	3,214,988	3,391,163	3,352,369	137,381	4%	-38,794	-1%
VMT/person	52.5	NA	48.4	-4.1	-8%	NA	NA
VMT/SP	31.1	30.3	29.1	-2.1	-7%	-1.3	-4%
<b>SOI</b>							
Population <sup>a</sup>	14,521	NA	15,421	900	6%	NA	NA
Employment	2,150	NA	2,215	65	3%	NA	NA
Service Population (SP)	16,671	17,286	17,636	965	6%	350	2%
VMT per Day <sup>c</sup>	399,338	420,975	385,521	-13,817	-3%	-35,454	-8%
VMT/person	27.5	NA	25.0	-2.5	-9%	NA	NA
VMT/SP	24.0	24.4	21.9	-2.1	-9%	-2.5	-10%

ZXXX

d. Based on VMT data provided by Kittelson & Associates, Inc.

Source: PlaceWorks 2018.

# **Solid Waste Disposal**

## Solid Waste Disposal

Source: CalRecycle Disposal By Facility - Marin County Hazardous and Solid Waste Management (Disposal Reporting System)

The **Marin County Hazardous and Solid Waste Management Joint Powers Authority** is an agency consisting of all 11 incorporated cities within Marin (Belvedere, Corte Madera, Fairfax, Larkspur, Mill Valley, Novato, Ross, San Anselmo, San Rafael, Sausalito, and Tiburon) and the County. Because of this, Calrecycle does not report solid waste disposal for San Rafael separate from the County. Solid Waste Disposal is estimated based on Service Population for the County of Marin v. San Rafael

Service Population of Marin County		Service Population of San Rafael				
		City	SOI	TOTAL	% of Total	
Employment <sup>1</sup>	112,468	2019 Service Population	103,280	16,671	119,951	32%
Population <sup>2</sup>	258,826	As a % of Total	86%	14%	% Increase in SP	
Service Population	371,294	2040 Service Population	115,340	17,636	132,976	11%
		As a % of Total	87%	13%		

Sources:

1 U.S. Census Bureau. Longitudinal Employer-Household Dynamics - Marin County. <http://lehd.ces.census.gov/>

2 U.S. Census Bureau. Quick Facts - Marin County. <https://www.census.gov/quickfacts/marincountycalifornia>

### Waste Generated Within Marin County

San Rafael is a member of a regional waste agency. As a result, waste disposal is not reported separately for the City:  
<https://www2.calrecycle.ca.gov/LGCentral/AnnualReporting/RegionalAgencies>

Year	Interstate Tons +		
	Transform Tons	ADC+AIC	Sludge
2016	223,074	21,214	5,317
2017	231,665	21,274	6,195
2018	250,470	35,354	5,705
Average 2018-2016	235,070	25,947	5,739
Redwood LF	134,862	54%	
Potrero Hills LF	97,201	41%	

Notes:

Average 3-year disposal used to forecast waste disposal in 2040

Source: CalRecycle, 2020, Disposal Reporting System, Jurisdiction Reporting by Facility, <https://www2.calrecycle.ca.gov/LGCentral/DisposalReporting/Destination/DisposalByFacility>

### Waste Generated Within San Rafael

Year	Interstate Tons +		
	Transform Tons	ADC+AIC	Sludge
2016	72,067	6,853	1,718
2017	74,842	6,873	2,002
2018	80,917	11,421	1,843
Average 2018-2016	75,942	8,382	1,854

### Landfill Emission Tool (version 1.3) CH<sub>4</sub> Model Results.

Based on the Redwood Landfill K-Factor (Worst Case)

	EXISTING				GENERAL PLAN			
	CH <sub>4</sub> Tons	MTCO <sub>2</sub> e w/LFG Capture	MTCO <sub>2</sub> e w/LFG Capture	MTCO <sub>2</sub> e w/LFG Capture	CH <sub>4</sub> Tons	MTCO <sub>2</sub> e w/LFG Capture	MTCO <sub>2</sub> e w/LFG Capture	MTCO <sub>2</sub> e w/LFG Capture
		2019 TOTAL	2019 City	2019 SOI		2040 TOTAL	2040 City	2040 SOI
Year 1	1,841	11,692	10,067	1,625	2,041	12,962	11,243	1,719
Year 2 (PEAK)	<b>3,591</b>	<b>22,801</b>	<b>19,632</b>	<b>3,169</b>	<b>3,980</b>	<b>25,277</b>	<b>21,924</b>	<b>3,352</b>
Year 3	3,457	21,951	18,900	3,051	3,832	24,334	21,107	3,227
Year 4	3,328	21,132	18,195	2,937	3,689	23,427	20,320	3,107
Year 5	3,204	20,344	17,517	2,827	3,552	22,553	19,562	2,991
Year 6	3,084	19,586	16,864	2,722	3,419	21,712	18,833	2,880
Year 7	2,969	18,855	16,235	2,621	3,292	20,903	18,131	2,772
Year 8	2,858	18,152	15,629	2,523	3,169	20,123	17,454	2,669
Year 9	2,752	17,475	15,047	2,429	3,051	19,373	16,804	2,569
Year 10	2,649	16,824	14,486	2,338	2,937	18,651	16,177	2,474
Year 11	2,551	16,197	13,946	2,251	2,827	17,955	15,574	2,381
Year 12	2,455	15,593	13,426	2,167	2,722	17,286	14,993	2,293
Year 13	2,364	15,011	12,925	2,086	2,621	16,641	14,434	2,207
Year 14	2,276	14,451	12,443	2,008	2,523	16,021	13,896	2,125
Year 15	2,191	13,913	11,979	1,934	2,429	15,423	13,378	2,046
Year 16	2,109	13,394	11,532	1,862	2,338	14,848	12,879	1,969
Year 17	2,031	12,894	11,102	1,792	2,251	14,295	12,399	1,896
Year 18	1,955	12,414	10,688	1,725	2,167	13,762	11,936	1,825
Year 19	1,882	11,951	10,290	1,661	2,086	13,248	11,491	1,757
Year 20	1,812	11,505	9,906	1,599	2,008	12,754	11,063	1,692
Year 21	1,744	11,076	9,537	1,539	1,934	12,279	10,650	1,628
Year 22	1,679	10,663	9,181	1,482	1,861	11,821	10,253	1,568
Year 23	1,617	10,266	8,839	1,427	1,792	11,380	9,871	1,509
Year 24	1,556	9,883	8,509	1,374	1,725	10,956	9,503	1,453
Year 25	1,498	9,514	8,192	1,322	1,661	10,547	9,149	1,399



Year 26	1,442	9,160	7,887	1,273	1,599	10,154	8,807	1,347
Year 27	1,389	8,818	7,592	1,226	1,539	9,776	8,479	1,296
Year 28	1,337	8,489	7,309	1,180	1,482	9,411	8,163	1,248
Year 29	1,287	8,173	7,037	1,136	1,427	9,060	7,859	1,202
Year 30	1,239	7,868	6,774	1,094	1,374	8,722	7,565	1,157
Year 31	1,193	7,575	6,522	1,053	1,322	8,397	7,283	1,114
Year 32	1,148	7,292	6,279	1,013	1,273	8,084	7,012	1,072
Year 33	1,105	7,020	6,045	976	1,226	7,783	6,750	1,032
Year 34	1,064	6,758	5,819	939	1,180	7,492	6,499	994
Year 35	1,025	6,506	5,602	904	1,136	7,213	6,256	957
Year 36	986	6,264	5,393	871	1,093	6,944	6,023	921
Year 37	950	6,030	5,192	838	1,053	6,685	5,798	887
Year 38	914	5,805	4,999	807	1,013	6,436	5,582	854
Year 39	880	5,589	4,812	777	976	6,196	5,374	822
Year 40	847	5,381	4,633	748	939	5,965	5,174	791
Year 41	816	5,180	4,460	720	904	5,742	4,981	762
Year 42	785	4,987	4,294	693	871	5,528	4,795	733
Year 43	756	4,801	4,134	667	838	5,322	4,616	706
Year 44	728	4,622	3,980	642	807	5,124	4,444	680
Year 45	701	4,450	3,831	618	777	4,933	4,278	654
Year 46	675	4,284	3,688	595	748	4,749	4,119	630
Year 47	649	4,124	3,551	573	720	4,572	3,965	606
Year 48	625	3,970	3,418	552	693	4,401	3,818	584
Year 49	602	3,822	3,291	531	667	4,237	3,675	562
Year 50	579	3,680	3,168	511	642	4,079	3,538	541
Year 51	558	3,542	3,050	492	618	3,927	3,406	521
Year 52	537	3,410	2,936	474	595	3,781	3,279	501
Year 53	517	3,283	2,827	456	573	3,640	3,157	483
Year 54	498	3,161	2,721	439	552	3,504	3,039	465
Year 55	479	3,043	2,620	423	531	3,373	2,926	447
Year 56	461	2,929	2,522	407	511	3,247	2,817	431
Year 57	444	2,820	2,428	392	492	3,126	2,712	415
Year 58	428	2,715	2,338	377	474	3,010	2,611	399
Year 59	412	2,614	2,251	363	456	2,898	2,513	384
Year 60	396	2,516	2,167	350	439	2,790	2,420	370
60 YR Avg		9,304	8,011	1,293		10,314	8,946	1,368

Waste. Landfill Emissions Tool Version 1.3 and CalRecycle. Biogenic CO<sub>2</sub> emissions are not included.

Notes

LFG capture Efficiency 0.75 AR5 CH<sub>4</sub> GWP 28 Tons to metric Tons 0.9071847

Waste generation based on three year average waste commitment for the County of Marin obtained from CalRecycle.

Significant CH<sub>4</sub> production typically begins one or two years after waste disposal in a landfill and continues for 10 to 60 years or longer. Consequently, the highest CH<sub>4</sub> emissions from waste disposal in a given year are reported.

Decomposition based on an average annual rainfall of 25 inches per year average (anaerobic decomposition factor (k) of 0.038) for the Redwood Landfill [WORST CASE] and an average annual rainfall of 17 inches per year average (anaerobic decomposition factor (k) of 0.02) for the Potrero Hills Landfill (WRCC 2020).

The Landfill Gas Estimator only includes the landfill gas (LFG) capture in the landfill gas heat output and therefore the reduction and emissions from landfill gas capture are calculated separately.

Assumes 75 percent of fugitive GHG emissions are captured within the landfill's Landfill Gas Capture System with a landfill gas capture efficiency of 75%. The Landfill gas capture efficiency is based on the California Air Resources Board's (CARB) Local Government Operations Protocol (LGOP), Version 1.3.

Biogenic CO<sub>2</sub> emissions are not included.

# **Water and Wastewater**

## Water and Wastewater

### Water Demand Calculations Derived from the Urban Water Management Plan

Table 5-12, 5-13, and 5-14: SBx7-7 Targets, Gallons Per Person Per Day (GPCD) <sup>1</sup>		
2015 Actual	2015	2020
Method 3	110	124

Source: Includes water from both residential and nonresidential uses. This value is used to forecast the CEQA Baseline and Proposed Project Water Use

<sup>1</sup> Marin Municipal Water District. 2016, June 11. 2015 Urban Water Management Plan. <http://marinwater.org/DocumentCenter/View/3828/MMWD-2015-UWMP-Final---Report-Only?bidId=>

San Rafael Gallons Per Capita Per Day (gpcd) <sup>2</sup>	2016 GPCD
	114

Source:

<sup>2</sup> Data provided by O'Rourke & Associate. Activity data used for the Marin Climate & Energy Partnership. 2018, February. City of San Rafael Community Greenhouse Gas Emissions Inventory for Year 2015.

### Water Use

Gallons Per Day		2016	CEQA Baseline	Proposed Project	Increase
City		6,915,354	6,735,300	7,616,400	881,100
SOI		0	1,597,310	1,696,310	99,000
Total		6,915,354	8,332,610	9,312,710	980,100
AFY		7,746	9,334	10,432	1,098
Million Gallons Per Year		2016	CEQA Baseline	Proposed Project	Increase
MGY City		2,524	2,458	2,780	322
MGY SOI		0	583	619	36
MGY TOTAL		2,524	3,041	3,399	358

WASTEWATER PERCENTAGE 70%

<sup>1</sup> Modeling conservatively assumes that 70 percent of water use is indoor water use (30% outdoor) and would require wastewater treatment. Source: Marin Municipal Water District, 2016. Urban Water Management Plan, 2015 Update. Prepared by RMC Water and Environment

## Water and Wastewater

### Fugitive Emissions - Process Emissions from WWTP with Nitrification/Denitrification

CH<sub>4</sub> - Microorganisms can biodegrade soluble organic material in wastewater under aerobic (presence of oxygen) or anaerobic (absence of oxygen) conditions. Anaerobic conditions result in the production of CH<sub>4</sub>.

N<sub>2</sub>O - Treatment of domestic wastewater during both nitrification and denitrification of the nitrogen present leads to the formation of N<sub>2</sub>O, usually in the form of urea, ammonia, and proteins. These compounds are converted to nitrate through the aerobic process of nitrification. Denitrification occurs under anoxic conditions (without free oxygen), and involves the biological conversion of nitrate into dinitrogen. N<sub>2</sub>O can be an intermediate product of both processes, but more often is associated with denitrification.

Notes: Waste discharge facilities in compliance with the United States Environmental Protection Agency's Clean Water Standards do not typically result in CH<sub>4</sub> emissions. However, poorly-operated aerobic wastewater treatment systems can result in the generation of CH<sub>4</sub>. Because wastewater treatment systems are assumed to operate in compliance with state and federal laws pertaining to water quality, CH<sub>4</sub> emissions from centralized aerobic treatments are not included in the inventory.

### Fugitive Emissions - Process Emissions from WWTP with Nitrification/Denitrification

LGOP Version 1.1, Equation 10.9.

$$N_2O = \text{Wastewater} \times 10^{-6} \times N\text{load} \times EF\text{ effluent} \times 10^3$$

	2016	CEQA Baseline	Proposed Project	Increase
City wastewater (Liters)=	6,687,614,104	6,513,489,733	7,365,572,907	852,083,174
SOI wastewater (Liters)=	0	1,544,706,588	1,640,446,271	95,739,683
TOTAL wastewater (Liters)=	6,687,614,104	8,058,196,321	9,006,019,178	947,822,857

10<sup>-6</sup> = 1.00E-06 conversion factor; kg/mg  
 N Load 40.00 mg/L of wastewater USEPA 2008  
 EF effluent 0.01 kg/N<sub>2</sub>O/kg N  
 10<sup>-3</sup> = 1.00E-03 conversion factor: MTons/kg

	2016	CEQA Baseline	Proposed Project	Increase
	MTons	2019	2040	2040-2019
N <sub>2</sub> O City	1.34	1.30	1.47	0.17
N <sub>2</sub> O SOI	0.00	0.31	0.33	0.02
N <sub>2</sub> O TOTAL	1.34	1.61	1.80	0.19
CO <sub>2</sub> e City=	354	345	390	45
CO <sub>2</sub> e SOI=	0	82	87	5
CO <sub>2</sub> e TOTAL=	354	427	477	50

Source: California Air Resources Board (CARB). 2010, May. Local Government Operations Protocol (LGOP), Version 1.1. The LGOP protocol provides default values for all the terms except the Nitrogen Load, which is assumed to be 40 mg of N per Liter of wastewater effluent based on USEPA methodology outlined in the CalEEMod program manual. South Coast Air Quality Management District (SCAQMD). 2011. California Emissions Estimator Model (CalEEMod), Version 2011.1.1. User's Manual. USEPA. 2008. Page 8-12. USEPA cites Metcalf & Eddy, Inc., 1991, "Wastewater Engineering: Treatment Disposal, and Reuse," 3rd Ed. McGraw Hill Publishing.

## Water and Wastewater

### Energy for Water Conveyance, Treatment, Distribution, and Wastewater Treatment (Northern California)

Water Supply and Conveyance	Water Treatment	Water Distribution	Total Water	Wastewater Treatment
kWhr/million gallons				
2,117	111	1,272	3,500	1,911

Source: California Energy Commission (CEC). 2006, December. Refining Estimates of Water-Related Energy Use in California. CEC-500-2006-118. Prepared by Navigant Consulting, Inc. Based on the electricity use for Northern California.

#### PG&E

	Intensity factor			CO <sub>2</sub> e
	CO <sub>2</sub> MTons/MWH <sup>1</sup>	CH <sub>4</sub> MTons/MWH <sup>2</sup>	N <sub>2</sub> O MTons/MWH <sup>2</sup>	MTons/MWh
2016	0.134	0.000013	0.000005	0.136

Source 1: California Public Utilities Commission. 2010, September 13. WCI Final Default Emission Factor Calculator 2008 Data, Version 2. WECC Region.  
Source 2: CH<sub>4</sub> and N<sub>2</sub>O intensity based on California E-Grid data (CH<sub>4</sub> = 0.029 lbs/MWh; N<sub>2</sub>O = 0.011 lbs/MWh) identified in the LGOP

#### GHG Emissions from Energy Associated with Water/Wastewater

Energy Associated with Water Use	2016 MWh/Year	CEQA Baseline 2019	Proposed Project 2040	Increase 2040-2019
City Water Use	8,834	8,604	9,730	1,126
SOI Water Use	0	2,041	2,167	126
<b>TOTAL Water Use</b>	<b>8,834</b>	<b>10,645</b>	<b>11,897</b>	<b>1,252</b>
City Wastewater Generation	3,376	3,289	3,719	430
SOI Wastewater Generation	0	780	828	48
<b>TOTAL Wastewater Generation</b>	<b>3,376</b>	<b>4,068</b>	<b>4,547</b>	<b>479</b>
<b>Total Water/Wastewater</b>	<b>12,211</b>	<b>14,713</b>	<b>16,444</b>	<b>1,731</b>

GHG Emissions from Energy Associated with Water Use/Wastewater Generation	2016 MTCO <sub>2</sub> e/Year	CEQA Baseline 2019	Proposed Project 2040	Increase 2040-2019
City Water Use	1,201	1,170	1,323	153
SOI Water Use	0	277	295	17
<b>TOTAL Water Use</b>	<b>1,201</b>	<b>1,447</b>	<b>1,617</b>	<b>170</b>
City Wastewater Generation	459	447	505	58
SOI Wastewater Generation	0	106	113	7
<b>TOTAL Wastewater Generation</b>	<b>459</b>	<b>553</b>	<b>618</b>	<b>65</b>
<b>Total Water/Wastewater</b>	<b>1,660</b>	<b>2,000</b>	<b>2,235</b>	<b>235</b>

#### Total GHGs

GHG Emissions from Water/Wastewater Use	2016 MTCO <sub>2</sub> e/Year	CEQA Baseline 2019	Proposed Project 2040	Increase 2040-2019
City Water Use	1,201	1,170	1,323	153
SOI Water Use	0	277	295	17
<b>TOTAL Water Use</b>	<b>1,201</b>	<b>1,447</b>	<b>1,617</b>	<b>170</b>
City Wastewater Generation	813	792	896	104
SOI Wastewater Generation	0	188	200	12
<b>TOTAL Wastewater Generation</b>	<b>813</b>	<b>980</b>	<b>1,095</b>	<b>115</b>
<b>Total Water/Wastewater</b>	<b>2,014</b>	<b>2,427</b>	<b>2,712</b>	<b>285</b>

# **Energy - Electricity and Natural Gas**

## Energy

### Emission Factors

Natural Gas	CO <sub>2</sub> e
	MT/Therm
All Years <sup>1</sup>	0.00416

Electricity	Carbon Intensity			CO <sub>2</sub> e	
	Current Percent Renewable <sup>4</sup>	CO <sub>2</sub> MTons/MWH <sup>1</sup>	CH <sub>4</sub> MTons/MWH <sup>2</sup>	N <sub>2</sub> O MTons/MWH <sup>2</sup>	MTons/MWh
PG&E	38.9%	0.134	0.000015	0.000002	0.135
MCE Light Green	61%	0.130	0.000015	0.000002	0.131
MCE Deep Green	100%	0.000	0.000015	0.000002	0.001
Other Direct Access	NA	0.240	0.000015	0.000002	0.241
2016-2019 Average Carbon Intensity <sup>1</sup>					0.201
2040 Average Carbon Intensity <sup>2</sup>					0.131

#### Sources

<sup>1</sup> Data provided by O'Rourke & Associate. Activity data used for the Marin Climate & Energy Partnership. 2018, February. City of San Rafael Community Greenhouse Gas Emissions Inventory for Year 2015. As noted in the inventory, transmission and distribution losses are included in reported emissions from electricity (4.23% in 2016).

<sup>2</sup> United State Environmental Protection Agency. 2017, February 27. eGRID2014v2 Annual Output Emission Rates, WECC California Region. [https://www.epa.gov/sites/production/files/2017-02/documents/eGRID2014\\_ghgoutputrates\\_v2.pdf](https://www.epa.gov/sites/production/files/2017-02/documents/eGRID2014_ghgoutputrates_v2.pdf) (CH<sub>4</sub> = 33.1 lbs/GWH & N<sub>2</sub>O = 4.0 lbs/GWH)

<sup>3</sup> In 2018, SB 100 (de León, 2018) was signed into law, which again increases the RPS to 60% by 2030 and encourages the state's electricity to come from carbon-free resources by 2045.

<sup>4</sup> PG&E 2019 Sustainability Report. Key Sustainability Indicators. [http://www.pgecorp.com/corp\\_responsibility/reports/2019/su04\\_key.html](http://www.pgecorp.com/corp_responsibility/reports/2019/su04_key.html)

<sup>4</sup> Marin Clean Energy. Energy Choices <https://www.mcecleanenergy.org/residential/#choices>

### GHG Emissions from Energy Use

Forecast Methodology	2016	CEQA Baseline	Proposed Project	Increase
Residential - Dwelling Units	23,885	29,529	33,989	4,460
City	23,885	24,109	28,159	4,050
SOI	0	5,420	5,830	410
Nonresidential - Employment	41,918	44,200	48,315	4,115
City	41,918	42,050	46,100	4,050
SOI	0	2,150	2,215	65

Kwh per Unit per year	4942	Therms per Unit per year	396
Kwh per Employee per year	5117	Therms per Employee per year	136

Electricity	2016	CEQA Baseline	Proposed Project	Increase
	Kwh	2019	2040	2019-2040
City - Residential	118,031,218	119,138,350	139,152,052	20,013,701
City - Nonresidential	214,481,019	215,158,769	235,881,552	20,722,783
City - TOTAL	332,512,237	334,297,120	375,033,603	40,736,484
SOI - Residential	0	26,783,768	28,809,846	2,026,078
SOI - Nonresidential	0	11,000,983	11,333,571	332,588
SOI- TOTAL	0	37,784,751	40,143,418	2,358,666
Total	332,512,237	409,866,622	455,320,439	45,453,816

Electricity	2016	CEQA Baseline	Proposed Project	Increase
	MTCO <sub>2</sub> e/Year	2019	2040	2019-2040
City	66,784	67,142	49,167	-17,975
SOI	0	7,589	5,263	-2,326
Total	66,784	74,731	54,430	-20,301

Natural Gas	2016	CEQA Baseline	Proposed Project	Increase
	Therms	2019	2040	2019-2040
City - Residential	9,467,604	9,556,410	11,161,763	1,605,353
City - Nonresidential	5,687,627	5,705,600	6,255,128	549,529
City - TOTAL	15,155,231	15,262,010	17,416,892	2,154,882
SOI - Residential	0	2,148,399	2,310,916	162,517
SOI - Nonresidential	0	291,725	300,545	8,820
SOI- TOTAL	0	2,440,124	2,611,461	171,337
Total	15,155,231	17,702,133	20,028,352	2,326,219

Natural Gas	2016	CEQA Baseline	Proposed Project	Increase
	MTCO <sub>2</sub> e/Year	2019	2040	2019-2040
City	63,067	63,511	72,479	8,967
SOI	0	10,154	10,867	713
Total	63,067	73,666	83,346	9,680

## Criteria Air Pollutants from Natural Gas

Rate	lbs/MBTU					
	ROG	NO <sub>x</sub>	CO	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Natural Gas						
Residential	0.01078431	0.09215686	0.03921569	0.00058824	0.00745098	0.00745098
Non-Residential	0.01078431	0.09803922	0.08235294	0.00058824	0.00745098	0.00745098

Source: CalEEMod Version 2016.2.2 (October 2017)

	2016	CEQA Baseline	Proposed Project	Increase
City - Residential	9,467,604	9,556,410	11,161,763	1,605,353
City - Nonresidential	5,687,627	5,705,600	6,255,128	549,529
City - TOTAL	15,155,231	15,262,010	17,416,892	2,154,882
SOI - Residential	0	2,148,399	2,310,916	162,517
SOI - Nonresidential	0	291,725	300,545	8,820
SOI- TOTAL	0	2,440,124	2,611,461	171,337
Total	15,155,231	17,702,133	20,028,352	2,326,219

Natural Gas	2019 lbs/day					
	ROG	NO <sub>x</sub>	CO	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
City	45	385	164	2	31	31
SOI	7	66	55	0	5	5
TOTAL	52	451	219	3	36	36

Natural Gas	Project 2040 lbs/day					
	ROG	NO <sub>x</sub>	CO	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
City	51	440	187	3	36	36
SOI	8	70	59	0	5	5
TOTAL	59	510	246	3	41	41
Increase from Baseline	7	59	27	0	5	5

### General Conversion Factors

Mmbtu to Therm	0.1
lbs to Tons	2000
Tons to MTon	0.9071847

Source: California Air Resources Board (CARB). 2010. Local Government Operations Protocol. Version 1.1. Appendix F, Standard Conversion Factors



# **Area Sources - Residential Consumer Product Use**

## Area Sources - Consumer Products

Source: CalEEMod Users Guide, Version 2016.3.2

### Residential Consumer Product Use<sup>a</sup>

$$\text{Emissions} = \text{EF} \times \text{Building Area}$$

$$\text{EF} = 2.14\text{E-}05 \text{ lbs/sqft/day}$$

Sources/Notes:

a. California Emissions Estimator Model, Version 2016.3.2, Users Guide, Appendix A.

### AVERAGE HOUSING SQFT ASSUMPTIONS

Year Structure was Built	Percent of Housing Stock <sup>a</sup>	Average Square Feet of New Single Family Homes <sup>b</sup>	
		Average Square Feet (Weighted)	Average Square Feet (Weighted)
2014 or Later	0.5%	2,617	13
2010 to 2013	1.0%	2,467	25
2000 to 2009	5.1%	2,404	123
1990 to 1999	8.7%	2,116	184
1980 to 1989	11.9%	1,819	216
1970 to 1979	17.7%	1,699	301
1960 to 1969	21.1%	1,715	362
1950 to 1959	17.2%	1,715	295
1940 to 1949	5.1%	1,715	87
1939 or earlier	11.7%	1,715	201
	100%		1,807

Sources/Notes:

a. United States Census Bureau, Selected Housing Characteristics, Marin County, 2018. Table DP04. American Community Survey 1-Year Estimates, Year structure built.

[https://data.census.gov/cedsci/table?q=Physical%20Housing%20Characteristics%20for%20Occupied%20Housing%20Units&hidePreview=false&tid=ACSDP1Y2018.DP04&t=Housing%20Units%3AHousing%3AYear%20Structure%20Built&vintage=2018&layer=VT\\_2018\\_050\\_00\\_PY\\_D1&cid=DP04\\_0016E&g=1600000US0668378\\_0500000US06041&moef=false](https://data.census.gov/cedsci/table?q=Physical%20Housing%20Characteristics%20for%20Occupied%20Housing%20Units&hidePreview=false&tid=ACSDP1Y2018.DP04&t=Housing%20Units%3AHousing%3AYear%20Structure%20Built&vintage=2018&layer=VT_2018_050_00_PY_D1&cid=DP04_0016E&g=1600000US0668378_0500000US06041&moef=false)

b. United States Census Bureau, Characteristics of New Housing, Characteristics of New Single-Family Houses Completed, Median and Average Square Feet by Location.

<https://www.census.gov/construction/chars/pdf/c25ann2016.pdf>

	2019			2040		
	CEQA Baseline	CEQA Baseline	CEQA Baseline	Proposed Project	Proposed Project	Proposed Project
	City	SOI	TOTAL	CITY	SOI	TOTAL
<b>Housing Units</b>	24,109	5,420	29,529	28,159	5,830	33,989
<b>Residential SQFT</b>	43,557,092	9,792,170	53,349,262	54,154,592	10,865,004	65,019,595
<b>lbs VOC per day</b>	932	210	1,142	1,159	233	1,391

Source

1 New housing units constructed post-2014 assumed to be 2,617 square feet (based on Source 2).

## **Area Sources - OFFROAD2017**

## Area Sources

Source: OFFROAD2017. <https://www.arb.ca.gov/orion/> Marin County Year 2019

### OFFROAD2017 Estimate based on:

Construction Equipment Based on the percentage of housing permits in the City compared to the County of Marin (HUD 2020)

Light Commercial and Portable Equipment Based on the percentage of employment in San Rafael compared to the County of Marin (US Census 2018)

Sources

#### Housing Permits

Source: Housing and Urban Development (HUD). 2020, Accessed May 19. SOCDS Building Permits Database. <https://socds.huduser.gov/permits/>

#### Employment

Source: U.S. Census Bureau. Longitudinal Employer-Household Dynamics. <http://lehd.ces.census.gov/>

2016	ROG Exhaust	NO <sub>x</sub> Exhaust	CO Exhaust	SO <sub>2</sub> Exhaust	PM <sub>10</sub> Exhaust	PM <sub>2.5</sub> Exhaust*	CO <sub>2</sub>
	lbs/day						MT/yr
Construction Equipment	3	9	118	0	1	1	201
Light Commercial Equipment	79	101	3,737	0	16	12	2,541
<b>TOTAL</b>	<b>82</b>	<b>110</b>	<b>3,854</b>	<b>0</b>	<b>17</b>	<b>13</b>	<b>2,742</b>
City	78	104	3,651	0	16	13	2,582
SOI	4	7	203	0	1	1	161

2040	ROG Exhaust	NO <sub>x</sub> Exhaust	CO Exhaust	SO <sub>2</sub> Exhaust	PM <sub>10</sub> Exhaust	PM <sub>2.5</sub> Exhaust*	CO <sub>2</sub>
	Forecast Adjusted for: lbs/day						MT/yr
Construction Equipment	Similar to historic	3	9	118	0	1	201
Light Commercial Equipment	Proportional to employment growth	86	111	4,085	0	18	2,777
<b>TOTAL</b>		<b>89</b>	<b>120</b>	<b>4,202</b>	<b>0</b>	<b>19</b>	<b>2,979</b>
City		85	113	3,982	0	18	2,807
SOI		5	7	220	0	1	172

**Marin County OFFROAD2017- 2016**

Source: OFFROAD 2017 (ORION Web database)

Construction includes: Over 25 horsepower, self-propelled, diesel equipment only subjected to In-Use Regulation; AND Under 25 horsepower equipment not subject to the In-Use Regulation

Region	CalYr	VehClass	MdlYr	HP_Bin	Fuel	ROG_tpd	NOx_tpd	CO_tpd	SOx_tpd	PM10_tpd	PM2_5_tpd	CO2_tpd	CO2e_MTY
Marin	2019	Construction and Mining	Aggregated	Aggregated	Diesel	0.00	0.04	0.03	0.00	0.00	0.00	5.88	1,948
Marin	2019	OFFROAD - Construction and Mining	Aggregated	Aggregated	Gasoline	0.02	0.02	0.81	0.00	0.01	0.01	1.94	641
Marin	2019	OFFROAD - Construction and Mining	Aggregated	Aggregated	Diesel	0.00	0.01	0.00	0.00	0.00	0.00	0.85	281
<b>TOTAL CONSTRUCTION OFFROAD</b>						0.02	0.06	0.84	0.00	0.01	0.01	8.67	2,870
ESTIMATED SAN RAFAEL						0.00	0.00	0.06	0.00	0.00	0.00	0.61	201
ESTIMATED SAN RAFAEL (lbs/day)						3	9	118	0	1	1	1217	
Marin	2019	OFFROAD - Light Commercial	Aggregated	Aggregated	Gasoline	0.09	0.08	4.61	0.00	0.02	0.01	11.61	3,844
Marin	2019	OFFROAD - Light Commercial	Aggregated	Aggregated	Diesel	0.01	0.04	0.04	0.00	0.00	0.00	4.99	1,651
Marin	2019	OFFROAD - Light Commercial	Aggregated	Aggregated	Nat Gas	0.00	0.01	0.11	0.00	0.00	0.00	2.93	970
<b>TOTAL LIGHT COMMERCIAL + PORTABLE OFFROAD</b>						0.10	0.13	4.75	0.00	0.02	0.02	19.53	6,465
ESTIMATED SAN RAFAEL						0.04	0.05	1.87	0.00	0.01	0.01	7.67	2,541
ESTIMATED SAN RAFAEL (lbs/day)						79	101	3737	0	16	12	15347	
<b>TOTAL OFFROAD in the City</b>						0	0	2	0	0	0	8	2,742

TOTAL UNITS: <a href="https://socds.huduser.gov/perr">https://socds.huduser.gov/perr</a>	2017	2018	2019	Average
Housing Permits in Marin County	94	160	240	
Housing Permits in San Rafael	3	11	10	
Percent in the City	11%	6%	4%	7%
	<b>2019</b>	City	SOI	
Employment in the Marin County	112,468			
Employment in San Rafael + SOI	44,200	42,050	2,150	
Percent in the City	39%	95%	5%	

City SOI  
82% 18% total units

# Transportation

## San Rafael — TRANSPORTATION SECTOR

Source: EMFAC2017, Web Database - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Based on the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) Global Warming Potentials (GWPs)

Note: MTons = metric tons; CO<sub>2</sub>e = carbon dioxide-equivalent. Includes Pavley + California Advanced Clean Car Standards, the Low Carbon Fuel Standard (LCFS), on-road diesel fleet rules, and the Smartway/Phase I Heavy Duty Vehicle Greenhouse Gas Regulation.

Criteria Air Pollutant Emissions						
	lbs/day					
	ROG	NOx	CO	SOx	PM10	PM2.5
<b>Year 2019</b>						
City	125	781	1,260	4	354	148
SOI	15	97	156	0	44	18
<b>TOTAL</b>	<b>140</b>	<b>878</b>	<b>1,416</b>	<b>4</b>	<b>398</b>	<b>166</b>
<b>Year 2040</b>						
City	96	317	3,978	16	372	151
SOI	11	36	457	2	43	17
<b>TOTAL</b>	<b>107</b>	<b>353</b>	<b>4,435</b>	<b>18</b>	<b>415</b>	<b>169</b>
<b>CEQA Baseline in 2040</b>						
City	92	304	3,815	15	357	145
SOI	11	38	474	2	44	18
<b>TOTAL</b>	<b>104</b>	<b>341</b>	<b>4,289</b>	<b>17</b>	<b>402</b>	<b>163</b>
<b>Change from Existing Land Uses (2040 rates)</b>						
City	4	13	163	1	15	6
SOI	0	-1	-16	0	-2	-1
<b>TOTAL</b>	<b>4</b>	<b>12</b>	<b>147</b>	<b>1</b>	<b>14</b>	<b>6</b>
<b>Change from Existing (2019) Conditions [Doesn't account for existing regulations]</b>						
City	-32	-477	2,555	11	3	-3
SOI	-4	-59	317	1	0	0
<b>TOTAL</b>	<b>-36</b>	<b>-537</b>	<b>2,872</b>	<b>13</b>	<b>4</b>	<b>-3</b>

Annual Criteria Air Pollutant Emissions						
	Tons/year					
	ROG	NOx	CO	SOx	PM10	PM2.5
Year 2019	24	152	246	1	69	29
Year 2040	19	61	770	3	72	29
CEQA Baseline in 2040	18	59	744	3	70	28

## GHG EMISSIONS

	MTons/year			
	N <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub> e
<b>Year 2019</b>				
City	8	373,265	9	375,518
SOI	1	46,364	1	46,644
<b>Total</b>	<b>9</b>	<b>419,628</b>	<b>10</b>	<b>422,162</b>
<b>Year 2040</b>				
City	2	277,064	4	277,721
SOI	0	31,862	0	31,938
<b>Total</b>	<b>2</b>	<b>308,926</b>	<b>4</b>	<b>309,659</b>
<b>Change from Existing</b>				
City	-6	-96,201	-5	-97,797
SOI	-1	-14,501	-1	-14,706
<b>Total</b>	<b>-6</b>	<b>-110,702</b>	<b>-5</b>	<b>-112,503</b>

Note: MTons = metric tons; CO<sub>2</sub>e = carbon dioxide-equivalent.

# San Rafael VMT

Source: F&P May 8, 2020

	Exiting (2019)			2040 General Plan			% Change VMT	Current General Plan		
	Daily VMT	Service Population	VMT/SP	Daily VMT	Service Population	VMT/SP		Daily VMT	Service Population	VMT/SP
City	3,214,988	103,280	31.1	3,352,369	115,340	29.1	4%	3,391,163	111,825	30.3
SOI	399,338	16,671	24.0	385,521	17,636	21.9	-3%	420,975	17,286	24.4
TOTAL	3,614,326	119,951	30.1	3,737,890	132,976	28.1	3%	3,812,138	129,111	29.5
Net				123,564	13,025	-2.0				

Notes: Total may not add to 100% due to rounding.



### Year 2019 Existing: Criteria Air Pollutants

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).  
 Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

		Daily VMT	Emission year							
		3,614,326	Year 2019		lbs/day					
Vehicle Type	Fuel Type	Speed	Percent of VMT	ROG	NOx	CO	SOx	PM10	PM2.5	
All Other Buses	Dsl	40	0.02%	0.25	4.19	0.95	0.01	0.33	0.22	
LDA	Dsl	40	0.95%	1.49	10.42	17.32	0.14	4.29	2.21	
LDA	Gas	40	52.16%	0.00	0.00	0.00	0.00	185.98	73.77	
LDA	Elec	0	1.38%	1.81	4.89	120.88	0.30	5.06	2.09	
LDT1	Dsl	40	0.00%	0.04	0.19	0.21	0.00	0.04	0.03	
LDT1	Gas	40	6.00%	0.00	0.00	0.00	0.00	21.39	8.48	
LDT1	Elec	0	0.02%	0.06	0.16	3.10	0.01	0.08	0.03	
LDT2	Dsl	40	0.24%	0.23	0.72	2.06	0.05	0.95	0.43	
LDT2	Gas	40	21.03%	0.00	0.00	0.00	0.00	74.97	29.74	
LDT2	Elec	0	0.11%	0.16	0.59	10.76	0.03	0.39	0.16	
LHD1	Dsl	40	1.14%	8.32	230.17	42.80	0.40	9.96	5.08	
LHD1	Gas	40	1.48%	5.51	24.90	147.40	0.85	10.12	4.24	
LHD2	Dsl	40	0.35%	1.94	46.56	9.64	0.14	3.31	1.61	
LHD2	Gas	40	0.19%	0.50	3.08	14.54	0.13	1.50	0.63	
MCY	Gas	40	0.64%	95.86	38.37	839.90	0.09	0.88	0.39	
MDV	Dsl	40	0.48%	0.41	1.91	6.77	0.13	1.90	0.87	
MDV	Gas	40	11.66%	0.00	0.00	0.00	0.00	41.56	16.48	
MDV	Elec	0	0.01%	0.03	0.11	1.70	0.00	0.05	0.02	
MH	Dsl	40	0.02%	0.13	6.51	0.61	0.02	0.46	0.28	
MH	Gas	40	0.06%	0.45	1.86	13.47	0.07	0.64	0.27	
Motor Coach	Dsl	40	0.02%	0.27	5.20	1.14	0.02	0.29	0.18	
OBUS	Gas	40	0.09%	0.41	2.64	13.71	0.11	1.00	0.42	
SBUS	Dsl	40	0.05%	0.27	28.98	1.00	0.04	3.24	1.45	
SBUS	Gas	40	0.02%	0.15	0.93	5.29	0.01	0.99	0.42	
T6 CAIRP Heavy	Dsl	40	0.01%	0.04	1.03	0.15	0.01	0.14	0.07	
T6 CAIRP Small	Dsl	40	0.00%	0.01	0.16	0.03	0.00	0.02	0.01	
T6 Instate Constru	Dsl	40	0.01%	0.20	3.85	0.73	0.01	0.26	0.17	
T6 Instate Constru	Dsl	40	0.06%	0.77	12.24	2.85	0.04	1.07	0.69	
T6 Instate Heavy	Dsl	40	0.24%	3.21	58.82	11.82	0.16	4.52	2.88	
T6 Instate Small	Dsl	40	0.39%	5.79	90.59	21.38	0.29	7.78	5.02	
T6 OOS Heavy	Dsl	40	0.01%	0.02	0.60	0.09	0.00	0.08	0.04	
T6 OOS Small	Dsl	40	0.00%	0.01	0.11	0.02	0.00	0.01	0.01	
T6 Public	Dsl	40	0.05%	0.12	14.84	0.45	0.04	0.61	0.29	
T6 Utility	Dsl	40	0.00%	0.01	0.38	0.02	0.00	0.04	0.02	
T6TS	Gas	40	0.20%	2.04	10.00	62.80	0.24	2.24	0.93	
T7 CAIRP	Dsl	40	0.13%	0.79	25.63	3.65	0.12	1.33	0.68	
T7 CAIRP Constru	Dsl	40	0.01%	0.06	1.82	0.26	0.01	0.10	0.05	
T7 NNOOS	Dsl	40	0.16%	1.03	27.55	4.79	0.14	1.72	0.92	
T7 NOOS	Dsl	40	0.05%	0.32	10.10	1.45	0.05	0.53	0.27	
T7 Other Port	Dsl	40	0.01%	0.13	3.72	0.42	0.01	0.13	0.06	
T7 POAK	Dsl	40	0.07%	0.82	22.80	2.57	0.08	0.72	0.37	
T7 Public	Dsl	40	0.04%	0.21	23.87	1.02	0.05	0.48	0.25	
T7 Single	Dsl	40	0.08%	1.65	33.29	6.95	0.09	1.48	1.06	
T7 Single Constru	Dsl	40	0.02%	0.44	9.63	1.89	0.03	0.41	0.29	
T7 SWCV	Dsl	40	0.03%	0.02	22.46	0.06	0.08	0.25	0.11	
T7 SWCV	NG	40	0.02%	0.16	2.39	9.97	0.00	0.20	0.08	
T7 Tractor	Dsl	40	0.23%	3.46	74.99	14.23	0.24	3.19	2.01	
T7 Tractor Constru	Dsl	40	0.02%	0.37	7.31	1.48	0.02	0.30	0.20	
T7 Utility	Dsl	40	0.00%	0.00	0.28	0.02	0.00	0.01	0.00	
T7IS	Gas	40	0.00%	0.10	0.86	10.33	0.01	0.02	0.01	
UBUS	Dsl	40	0.03%	0.00	5.62	0.29	0.03	0.33	0.14	
UBUS	Gas	40	0.04%	0.03	0.42	0.81	0.05	0.42	0.18	
UBUS	NG	40	0.00%	0.00	0.02	2.41	0.00	0.01	0.00	
			<b>100%</b>	<b>140.11</b>	<b>877.74</b>	<b>1,416.18</b>	<b>4.33</b>	<b>397.76</b>	<b>166.31</b>	
			<b>City</b>	125	781	1,260	4	354	148	
			<b>SOI</b>	15	97	156	0	44	18	

**Year 2019**

**GHG Emissions**

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

N2O emissions were calculated using an off-model adjustment provided by CARB in the 2014 Scoping Plan Update. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0416 x NOx)

VMT Adjustments to adjust Daily to Annual			
	Daily	Annual	Percentage
City	3,214,988	1,115,600,831	89%
SOI	399,338	138,570,291	11%
<b>TOTAL</b>	<b>3,614,326</b>	<b>1,254,171,122</b>	<b>100%</b>

<sup>1</sup> Based on data provided Fehr & Peers.

<sup>2</sup> Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the 2008 Climate Change Scoping Plan Measure Documentation Supplement.

Annual VMT	Emission year	N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>
		AR5 GWP	AR5 GWP	AR5 GWP
<b>1,254,171,122</b>	<b>Year 2019</b>	265	1	28

Vehicle Type	Fuel Type	Speed	Percent of VMT	NOx	N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	CO <sub>2</sub> e w/ Pavley + LCFS
All Other Buses	Dsl	40	0.02%	0.66	0.03	192	0.00	200
LDA	Dsl	40	0.95%	1.64	0.07	2,341	0.01	2,360
LDA	Elec	0	1.38%	0.00	0.00	0	0.00	0
LDA	Gas	40	52.16%	29.13	1.21	179,507	3.01	179,913
LDT1	Dsl	40	0.00%	0.03	0.00	10	0.00	10
LDT1	Elec	0	0.02%	0.00	0.00	0	0.00	0
LDT1	Gas	40	6.00%	6.97	0.29	23,684	0.64	23,779
LDT2	Dsl	40	0.24%	0.11	0.00	813	0.00	814
LDT2	Elec	0	0.11%	0.00	0.00	0	0.00	0
LDT2	Gas	40	21.03%	18.33	0.76	90,996	1.42	91,237
LHD1	Dsl	40	1.14%	36.23	1.51	6,547	0.06	6,948
LHD1	Gas	40	1.48%	3.92	0.16	13,418	0.19	13,467
LHD2	Dsl	40	0.35%	7.33	0.30	2,242	0.01	2,323
LHD2	Gas	40	0.19%	0.48	0.02	1,984	0.02	1,990
MCY	Gas	40	0.64%	6.04	0.25	1,213	2.31	1,344
MDV	Dsl	40	0.48%	0.30	0.01	2,120	0.00	2,123
MDV	Elec	0	0.01%	0.00	0.00	0	0.00	0
MDV	Gas	40	11.66%	13.70	0.57	60,301	1.08	60,483
MH	Dsl	40	0.02%	1.02	0.04	293	0.00	305
MH	Gas	40	0.06%	0.29	0.01	1,058	0.01	1,062
Motor Coach	Dsl	40	0.02%	0.82	0.03	277	0.00	286
OBUS	Gas	40	0.09%	0.41	0.02	1,678	0.02	1,683
SBUS	Dsl	40	0.05%	4.56	0.19	688	0.00	739
SBUS	Gas	40	0.02%	0.15	0.01	145	0.01	147
T6 CAIRP Heavy	Dsl	40	0.01%	0.16	0.01	109	0.00	111
T6 CAIRP Small	Dsl	40	0.00%	0.03	0.00	11	0.00	12
T6 Instate Construction Heavy	Dsl	40	0.01%	0.61	0.03	157	0.00	164
T6 Instate Construction Small	Dsl	40	0.06%	1.93	0.08	662	0.01	684
T6 Instate Heavy	Dsl	40	0.24%	9.26	0.39	2,693	0.02	2,796
T6 Instate Small	Dsl	40	0.39%	14.26	0.59	4,718	0.04	4,876
T6 OOS Heavy	Dsl	40	0.01%	0.09	0.00	66	0.00	67
T6 OOS Small	Dsl	40	0.00%	0.02	0.00	10	0.00	10
T6 Public	Dsl	40	0.05%	2.34	0.10	582	0.00	608
T6 Utility	Dsl	40	0.00%	0.06	0.00	41	0.00	42
T6TS	Gas	40	0.20%	1.57	0.07	3,707	0.07	3,726
T7 CAIRP	Dsl	40	0.13%	4.03	0.17	2,050	0.01	2,094
T7 CAIRP Construction	Dsl	40	0.01%	0.29	0.01	152	0.00	155
T7 NNOOS	Dsl	40	0.16%	4.34	0.18	2,392	0.01	2,440
T7 NOOS	Dsl	40	0.05%	1.59	0.07	806	0.00	823
T7 Other Port	Dsl	40	0.01%	0.59	0.02	238	0.00	245
T7 POAK	Dsl	40	0.07%	3.59	0.15	1,340	0.01	1,380
T7 Public	Dsl	40	0.04%	3.76	0.16	827	0.00	869

## Year 2019

## GHG Emissions

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

N<sub>2</sub>O emissions were calculated using an off-model adjustment provided by CARB in the 2014 Scoping Plan Update. The off-model adjustment uses a linear regression correlating N<sub>2</sub>O with NO<sub>x</sub>. (N<sub>2</sub>O = 0.0416 x NO<sub>x</sub>)

VMT Adjustments to adjust Daily to Annual			
	Daily	Annual	Percentage
City	3,214,988	1,115,600,831	89%
SOI	399,338	138,570,291	11%
TOTAL	3,614,326	1,254,171,122	100%

<sup>1</sup> Based on data provided Fehr & Peers.

<sup>2</sup> Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the 2008 Climate Change Scoping Plan Measure Documentation Supplement.

Annual VMT		Emission year		N <sub>2</sub> O		CO <sub>2</sub> (Pavley)		CH <sub>4</sub>	
				AR5 GWP	AR5 GWP	AR5 GWP	AR5 GWP	AR5 GWP	AR5 GWP
<b>1,254,171,122</b>		<b>Year 2019</b>		265	1	28			

  

Vehicle Type	Fuel Type	Speed	Percent of VMT	NO <sub>x</sub>	N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	CO <sub>2</sub> e w/ Pavley + LCFS
T7 Single	Dsl	40	0.08%	5.24	0.22	1,443	0.01	1,501
T7 Single Construction	Dsl	40	0.02%	1.52	0.06	417	0.00	434
T7 SWCV	Dsl	40	0.03%	3.54	0.15	1,326	0.00	1,365
T7 SWCV	NG	40	0.02%	0.38	0.02	803	0.53	822
T7 Tractor	Dsl	40	0.23%	11.80	0.49	3,893	0.03	4,024
T7 Tractor Construction	Dsl	40	0.02%	1.15	0.05	343	0.00	356
T7 Utility	Dsl	40	0.00%	0.04	0.00	19	0.00	20
T7IS	Gas	40	0.00%	0.13	0.01	90	0.00	91
UBUS	Dsl	40	0.03%	0.89	0.04	499	0.03	510
UBUS	Gas	40	0.04%	0.07	0.00	711	0.00	711
UBUS	NG	40	0.00%	0.00	0.00	16	0.04	17
			<b>100%</b>	<b>205.37</b>	<b>8.54</b>	<b>419,628</b>	<b>9.62</b>	<b>422,162</b>
			<b>City</b>	<b>183</b>	<b>8</b>	<b>373,265</b>	<b>9</b>	<b>375,518</b>
			<b>SOI</b>	<b>23</b>	<b>1</b>	<b>46,364</b>	<b>1</b>	<b>46,644</b>







## Existing with Year 2040 Rates: Criteria Air Pollutants

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

		Emission year								
3,614,326		Year 2040								
		lbs/day								
Vehicle Type	Fuel Type	Speed	Percent of VMT	ROG	NOx	CO	SOx	PM10	PM2.5	
All Other Buses	Dsl	40	0.04%	0.02	2.43	0.18	0.02	0.44	0.19	
LDA	Dsl	40	0.65%	0.19	0.46	6.24	0.07	2.45	1.00	
LDA	Elec	0	3.87%	0.00	0.00	0.00	0.00	14.16	5.62	
LDA	Gas	40	52.06%	7.45	48.73	1,969.56	7.78	192.68	77.48	
LDT1	Dsl	40	0.00%	0.00	0.00	0.01	0.00	0.00	0.00	
LDT1	Elec	0	0.25%	0.00	0.00	0.00	0.00	0.93	0.37	
LDT1	Gas	40	5.93%	0.97	6.09	229.05	1.02	21.96	8.84	
LDT2	Dsl	40	0.19%	0.17	0.35	1.87	0.03	0.77	0.34	
LDT2	Elec	0	0.63%	0.00	0.00	0.00	0.00	2.31	0.91	
LDT2	Gas	40	18.13%	3.89	18.50	800.64	3.08	67.15	27.02	
LHD1	Dsl	40	1.20%	3.33	14.37	15.86	0.33	9.11	4.03	
LHD1	Gas	40	1.21%	0.28	2.86	12.28	0.56	8.22	3.43	
LHD2	Dsl	40	0.47%	1.30	5.79	6.20	0.14	4.25	2.00	
LHD2	Gas	40	0.18%	0.04	0.36	1.80	0.10	1.42	0.59	
MCY	Gas	40	0.59%	81.18	34.56	668.64	0.09	0.83	0.37	
MDV	Dsl	40	0.41%	0.14	0.29	4.48	0.07	1.55	0.64	
MDV	Elec	0	0.46%	0.00	0.00	0.00	0.00	1.67	0.66	
MDV	Gas	40	11.17%	2.58	12.51	499.16	2.28	41.36	16.65	
MH	Dsl	40	0.03%	0.07	3.54	0.24	0.02	0.35	0.17	
MH	Gas	40	0.06%	0.03	0.30	0.78	0.05	0.64	0.27	
Motor Coach	Dsl	40	0.02%	0.02	1.88	0.21	0.01	0.23	0.10	
OBUS	Gas	40	0.05%	0.05	0.38	1.53	0.05	0.56	0.23	
SBUS	Dsl	40	0.05%	0.04	3.41	0.27	0.03	3.06	1.31	
SBUS	Gas	40	0.04%	0.02	0.22	0.54	0.02	2.17	0.93	
T6 CAIRP Heavy	Dsl	40	0.01%	0.00	0.62	0.05	0.01	0.14	0.06	
T6 CAIRP Small	Dsl	40	0.00%	0.00	0.00	0.00	0.00	0.00	0.00	
T6 Instate Construction Heavy	Dsl	40	0.02%	0.01	1.56	0.11	0.01	0.25	0.11	
T6 Instate Construction Small	Dsl	40	0.09%	0.04	5.43	0.43	0.05	1.09	0.47	
T6 Instate Heavy	Dsl	40	0.28%	0.13	17.88	1.35	0.14	3.23	1.40	
T6 Instate Small	Dsl	40	0.37%	0.16	21.76	1.72	0.19	4.33	1.86	
T6 OOS Heavy	Dsl	40	0.01%	0.00	0.41	0.03	0.00	0.09	0.04	
T6 OOS Small	Dsl	40	0.00%	0.00	0.07	0.01	0.00	0.01	0.01	
T6 Public	Dsl	40	0.07%	0.03	3.69	0.29	0.03	0.77	0.33	
T6 Utility	Dsl	40	0.00%	0.00	0.15	0.01	0.00	0.05	0.02	
T6TS	Gas	40	0.23%	0.15	1.08	3.82	0.21	2.63	1.09	
T7 CAIRP	Dsl	40	0.16%	0.17	18.17	1.98	0.10	1.38	0.58	
T7 CAIRP Construction	Dsl	40	0.02%	0.02	1.77	0.19	0.01	0.13	0.06	
T7 NNOOS	Dsl	40	0.20%	0.19	20.18	2.27	0.12	1.67	0.69	
T7 NOOS	Dsl	40	0.06%	0.07	7.12	0.78	0.04	0.54	0.23	
T7 Other Port	Dsl	40	0.02%	0.02	2.13	0.23	0.01	0.15	0.06	
T7 POAK	Dsl	40	0.16%	0.18	20.12	2.13	0.11	1.41	0.60	
T7 Public	Dsl	40	0.07%	0.08	7.53	0.71	0.05	0.58	0.23	
T7 Single	Dsl	40	0.08%	0.08	8.19	0.93	0.06	0.71	0.29	
T7 Single Construction	Dsl	40	0.04%	0.04	3.66	0.42	0.03	0.32	0.13	
T7 SWCV	Dsl	40	0.00%	0.00	2.21	0.01	0.01	0.03	0.01	
T7 SWCV	NG	40	0.03%	0.06	0.63	11.17	0.00	0.21	0.08	
T7 Tractor	Dsl	40	0.30%	0.32	34.50	3.75	0.20	2.61	1.10	
T7 Tractor Construction	Dsl	40	0.03%	0.03	3.84	0.41	0.02	0.28	0.12	
T7 Utility	Dsl	40	0.00%	0.00	0.08	0.01	0.00	0.01	0.00	
T7IS	Gas	40	0.00%	0.05	0.35	5.41	0.00	0.01	0.01	
UBUS	Dsl	40	0.02%	0.00	0.40	0.11	0.02	0.23	0.10	
UBUS	Gas	40	0.04%	0.03	0.44	0.81	0.03	0.41	0.17	
UBUS	NG	40	0.01%	0.05	0.26	29.97	0.00	0.09	0.03	
				<b>1.00</b>	<b>103.70</b>	<b>341.23</b>	<b>4,288.66</b>	<b>17.19</b>	<b>401.60</b>	<b>163.04</b>
<b>City</b>				92	304	3,815	15	357	145	
<b>SOI</b>				11	38	474	2	44	18	

## Year 2040 Project: Criteria Air Pollutants

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

		Emission year										
		3,737,890		Year 2040							lbs/day	
Vehicle Type	Fuel Type	Speed	Percent of VMT	ROG	NOx	CO	SOx	PM10	PM2.5			
All Other Buses	Dsl	40	0.04%	0.02	2.51	0.19	0.02	0.45	0.20			
LDA	Dsl	40	0.65%	0.20	0.48	6.46	0.07	2.53	1.03			
LDA	Elec	0	3.87%	0.00	0.00	0.00	0.00	14.64	5.81			
LDA	Gas	40	52.06%	7.70	50.39	2,036.89	8.05	199.26	80.13			
LDT1	Dsl	40	0.00%	0.00	0.00	0.01	0.00	0.00	0.00			
LDT1	Elec	0	0.25%	0.00	0.00	0.00	0.00	0.96	0.38			
LDT1	Gas	40	5.93%	1.00	6.29	236.89	1.05	22.71	9.14			
LDT2	Dsl	40	0.19%	0.18	0.37	1.94	0.03	0.79	0.35			
LDT2	Elec	0	0.63%	0.00	0.00	0.00	0.00	2.38	0.95			
LDT2	Gas	40	18.13%	4.03	19.13	828.01	3.19	69.44	27.95			
LHD1	Dsl	40	1.20%	3.44	14.86	16.40	0.34	9.42	4.16			
LHD1	Gas	40	1.21%	0.29	2.96	12.70	0.58	8.50	3.55			
LHD2	Dsl	40	0.47%	1.35	5.99	6.41	0.15	4.40	2.07			
LHD2	Gas	40	0.18%	0.04	0.37	1.86	0.10	1.47	0.61			
MCY	Gas	40	0.59%	83.95	35.74	691.50	0.09	0.86	0.38			
MDV	Dsl	40	0.41%	0.15	0.30	4.63	0.08	1.61	0.66			
MDV	Elec	0	0.46%	0.00	0.00	0.00	0.00	1.72	0.68			
MDV	Gas	40	11.17%	2.67	12.94	516.22	2.36	42.77	17.22			
MH	Dsl	40	0.03%	0.08	3.66	0.25	0.02	0.36	0.18			
MH	Gas	40	0.06%	0.04	0.31	0.81	0.05	0.66	0.27			
Motor Coach	Dsl	40	0.02%	0.02	1.94	0.22	0.02	0.24	0.11			
OBUS	Gas	40	0.05%	0.05	0.39	1.58	0.05	0.58	0.24			
SBUS	Dsl	40	0.05%	0.04	3.53	0.28	0.03	3.16	1.36			
SBUS	Gas	40	0.04%	0.02	0.23	0.55	0.02	2.24	0.96			
T6 CAIRP Heavy	Dsl	40	0.01%	0.01	0.64	0.05	0.01	0.15	0.06			
T6 CAIRP Small	Dsl	40	0.00%	0.00	0.00	0.00	0.00	0.00	0.00			
T6 Instate Construction Heavy	Dsl	40	0.02%	0.01	1.61	0.12	0.01	0.26	0.11			
T6 Instate Construction Small	Dsl	40	0.09%	0.04	5.62	0.45	0.05	1.13	0.48			
T6 Instate Heavy	Dsl	40	0.28%	0.13	18.49	1.40	0.14	3.34	1.45			
T6 Instate Small	Dsl	40	0.37%	0.17	22.50	1.78	0.19	4.48	1.93			
T6 OOS Heavy	Dsl	40	0.01%	0.00	0.42	0.04	0.00	0.10	0.04			
T6 OOS Small	Dsl	40	0.00%	0.00	0.07	0.01	0.00	0.02	0.01			
T6 Public	Dsl	40	0.07%	0.04	3.82	0.30	0.04	0.80	0.34			
T6 Utility	Dsl	40	0.00%	0.00	0.15	0.02	0.00	0.05	0.02			
T6TS	Gas	40	0.23%	0.15	1.12	3.95	0.22	2.72	1.13			
T7 CAIRP	Dsl	40	0.16%	0.17	18.79	2.05	0.10	1.43	0.60			
T7 CAIRP Construction	Dsl	40	0.02%	0.02	1.83	0.20	0.01	0.14	0.06			
T7 NNOOS	Dsl	40	0.20%	0.20	20.87	2.35	0.13	1.73	0.72			
T7 NOOS	Dsl	40	0.06%	0.07	7.37	0.80	0.04	0.56	0.24			
T7 Other Port	Dsl	40	0.02%	0.02	2.20	0.23	0.01	0.16	0.07			
T7 POAK	Dsl	40	0.16%	0.19	20.81	2.20	0.11	1.46	0.62			
T7 Public	Dsl	40	0.07%	0.09	7.79	0.73	0.06	0.60	0.24			
T7 Single	Dsl	40	0.08%	0.08	8.47	0.96	0.07	0.74	0.30			
T7 Single Construction	Dsl	40	0.04%	0.04	3.79	0.43	0.03	0.33	0.14			
T7 SWCV	Dsl	40	0.00%	0.00	2.28	0.01	0.01	0.03	0.01			
T7 SWCV	NG	40	0.03%	0.07	0.65	11.56	0.00	0.21	0.08			
T7 Tractor	Dsl	40	0.30%	0.33	35.68	3.87	0.20	2.70	1.14			
T7 Tractor Construction	Dsl	40	0.03%	0.04	3.97	0.42	0.02	0.29	0.12			
T7 Utility	Dsl	40	0.00%	0.00	0.08	0.01	0.00	0.01	0.00			
T7IS	Gas	40	0.00%	0.05	0.37	5.60	0.00	0.01	0.01			
UBUS	Dsl	40	0.02%	0.00	0.41	0.12	0.02	0.24	0.10			
UBUS	Gas	40	0.04%	0.03	0.45	0.84	0.03	0.42	0.18			
UBUS	NG	40	0.01%	0.05	0.27	30.99	0.00	0.09	0.04			
				100%	107.25	352.90	4,435.28	17.78	415.33	168.61		
City				96	317	3,978	16	372	151			
SOI				11	36	457	2	43	17			



## 2040 Rates

## GHG Emissions: Existing

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

N<sub>2</sub>O emissions were calculated using an off-model adjustment provided by CARB in the 2014 Scoping Plan Update. The off-model adjustment uses a linear regression correlating N<sub>2</sub>O with NO<sub>x</sub>. (N<sub>2</sub>O = 0.0416 x NO<sub>x</sub>)

VMT Adjustments to adjust Daily to Annual			
	Daily	Annual	Percentage
City	3,214,988	1,115,600,831	89%
SOI	399,338	138,570,291	11%
<b>TOTAL</b>	<b>3,614,326</b>	<b>1,254,171,122</b>	<b>100%</b>

<sup>1</sup>. Based on data provided Fehr & Peers.

<sup>2</sup>. Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the 2008 Climate Change Scoping Plan Measure Documentation Supplement.

Emission year					N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	
2040 Rates					AR5 GWP	AR5 GWP	AR5 GWP	CO <sub>2</sub> e w/ Pavley + LCFF
1,254,171,122					265	1	28	
Vehicle Type	Fuel Type	Speed*	Percent of VMT	NO <sub>x</sub>	N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	CO <sub>2</sub> e w/ Pavley + LCFF
All Other Buses	Dsl	40	0.04%	0.38	0.02	318.15	0.00	322
LDA	Dsl	40	0.65%	0.07	0.00	1,240.02	0.00	1,241
LDA	Elec	0	3.87%	0.00	0.00	0.00	0.00	0
LDA	Gas	40	52.06%	7.67	0.32	136,554.95	0.51	136,654
LDT1	Dsl	40	0.00%	0.00	0.00	2.86	0.00	3
LDT1	Elec	0	0.25%	0.00	0.00	0.00	0.00	0
LDT1	Gas	40	5.93%	0.96	0.04	17,876.65	0.06	17,889
LDT2	Dsl	40	0.19%	0.06	0.00	487.09	0.00	488
LDT2	Elec	0	0.63%	0.00	0.00	0.00	0.00	0
LDT2	Gas	40	18.13%	2.91	0.12	54,052.47	0.25	54,092
LHD1	Dsl	40	1.20%	2.26	0.09	5,362.12	0.02	5,388
LHD1	Gas	40	1.21%	0.45	0.02	8,793.11	0.02	8,799
LHD2	Dsl	40	0.47%	0.91	0.04	2,344.38	0.01	2,355
LHD2	Gas	40	0.18%	0.06	0.00	1,511.21	0.00	1,512
MCY	Gas	40	0.59%	5.44	0.23	1,161.77	2.03	1,279
MDV	Dsl	40	0.41%	0.05	0.00	1,225.39	0.00	1,226
MDV	Elec	0	0.46%	0.00	0.00	0.00	0.00	0
MDV	Gas	40	11.17%	1.97	0.08	40,031.54	0.16	40,058
MH	Dsl	40	0.03%	0.56	0.02	249.60	0.00	256
MH	Gas	40	0.06%	0.05	0.00	830.10	0.00	831
Motor Coach	Dsl	40	0.02%	0.30	0.01	246.74	0.00	250
OBUS	Gas	40	0.05%	0.06	0.00	731.83	0.00	733
SBUS	Dsl	40	0.05%	0.54	0.02	445.62	0.00	452
SBUS	Gas	40	0.04%	0.03	0.00	267.64	0.00	268
T6 CAIRP Heavy	Dsl	40	0.01%	0.10	0.00	89.88	0.00	91
T6 CAIRP Small	Dsl	40	0.00%	0.00	0.00	0.06	0.00	0
T6 Instate Construction Heavy	Dsl	40	0.02%	0.25	0.01	196.24	0.00	199
T6 Instate Construction Small	Dsl	40	0.09%	0.86	0.04	778.82	0.00	788
T6 Instate Heavy	Dsl	40	0.28%	2.81	0.12	2,235.17	0.00	2,266
T6 Instate Small	Dsl	40	0.37%	3.42	0.14	3,107.33	0.00	3,145
T6 OOS Heavy	Dsl	40	0.01%	0.06	0.00	59.13	0.00	60
T6 OOS Small	Dsl	40	0.00%	0.01	0.00	10.33	0.00	10
T6 Public	Dsl	40	0.07%	0.58	0.02	576.68	0.00	583
T6 Utility	Dsl	40	0.00%	0.02	0.00	31.98	0.00	32
T6TS	Gas	40	0.23%	0.17	0.01	3,386.90	0.01	3,389
T7 CAIRP	Dsl	40	0.16%	2.86	0.12	1,643.12	0.00	1,675
T7 CAIRP Construction	Dsl	40	0.02%	0.28	0.01	175.38	0.00	178
T7 NNOOS	Dsl	40	0.20%	3.18	0.13	2,003.08	0.00	2,038
T7 NOOS	Dsl	40	0.06%	1.12	0.05	643.39	0.00	656
T7 Other Port	Dsl	40	0.02%	0.34	0.01	188.22	0.00	192
T7 POAK	Dsl	40	0.16%	3.17	0.13	1,759.85	0.00	1,795
T7 Public	Dsl	40	0.07%	1.19	0.05	881.21	0.00	894
T7 Single	Dsl	40	0.08%	1.29	0.05	1,065.68	0.00	1,080
T7 Single Construction	Dsl	40	0.04%	0.58	0.02	475.15	0.00	482
T7 SWCV	Dsl	40	0.00%	0.35	0.01	161.07	0.00	165

## 2040 Rates

## GHG Emissions: Existing

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

N2O emissions were calculated using an off-model adjustment provided by CARB in the 2014 Scoping Plan Update. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0416 x NOx)

VMT Adjustments to adjust Daily to Annual			
	Daily	Annual	Percentage
City	3,214,988	1,115,600,831	89%
SOI	399,338	138,570,291	11%
<b>TOTAL</b>	<b>3,614,326</b>	<b>1,254,171,122</b>	<b>100%</b>

<sup>1</sup>. Based on data provided Fehr & Peers.

<sup>2</sup>. Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the 2008 Climate Change Scoping Plan Measure Documentation Supplement.

Vehicle Type	Fuel Type	Speed*	Percent of VMT	NOx	Emission year			CO <sub>2</sub> e w/ Pavley + LCFS
					2040 Rates	N <sub>2</sub> O AR5 GWP	CO <sub>2</sub> (Pavley) AR5 GWP	
					1,254,171,122	265	1	28
T7 SWCV	NG	40	0.03%	0.10	0.00	700.11	0.49	715
T7 Tractor	Dsl	40	0.30%	5.43	0.23	3,238.78	0.00	3,299
T7 Tractor Construction	Dsl	40	0.03%	0.60	0.03	383.47	0.00	390
T7 Utility	Dsl	40	0.00%	0.01	0.00	14.00	0.00	14
T7IS	Gas	40	0.00%	0.06	0.00	36.73	0.00	37
UBUS	Dsl	40	0.02%	0.06	0.00	305.55	0.01	307
UBUS	Gas	40	0.04%	0.07	0.00	512.45	0.00	513
UBUS	NG	40	0.01%	0.04	0.00	178.01	0.54	194
			<b>100%</b>	<b>53.71</b>	<b>2.23</b>	<b>298,571.02</b>	<b>4.16</b>	<b>299,280</b>
			<b>City</b>	<b>48</b>	<b>2</b>	<b>265,583</b>	<b>4</b>	<b>266,213</b>
			<b>SOI</b>	<b>6</b>	<b>0</b>	<b>32,988</b>	<b>0</b>	<b>33,067</b>

**Year 2040**

**GHG Emissions: Project**

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

N2O emissions were calculated using an off-model adjustment provided by CARB in the 2014 Scoping Plan Update. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0416 x NOx)

VMT Adjustments to adjust Daily to Annual			
	Daily	Annual	Percentage
City	3,352,369	1,163,272,201	90%
SOI	385,521	133,775,629	10%
<b>TOTAL</b>	<b>3,737,890</b>	<b>1,297,047,830</b>	<b>100%</b>

<sup>1</sup> Based on data provided Fehr & Peers.

<sup>2</sup> Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the 2008 Climate Change Scoping Plan Measure Documentation Supplement.

Emission year					N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	
					AR5 GWP	AR5 GWP	AR5 GWP	
<b>1,297,047,830 Year 2040</b>					265	1	28	
Vehicle Type	Fuel Type	Speed*	Percent of VMT	NOx	N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	CO <sub>2</sub> e w/ Pavley + LCFS
All Other Buses	Dsl	40	0.04%	0.40	0.02	329.03	0.00	333
LDA	Dsl	40	0.65%	0.08	0.00	1,282.41	0.00	1,283
LDA	Elec	0	3.87%	0.00	0.00	0.00	0.00	0
LDA	Gas	40	52.06%	7.93	0.33	141,223.39	0.53	141,326
LDT1	Dsl	40	0.00%	0.00	0.00	2.95	0.00	3
LDT1	Elec	0	0.25%	0.00	0.00	0.00	0.00	0
LDT1	Gas	40	5.93%	0.99	0.04	18,487.80	0.07	18,501
LDT2	Dsl	40	0.19%	0.06	0.00	503.74	0.00	504
LDT2	Elec	0	0.63%	0.00	0.00	0.00	0.00	0
LDT2	Gas	40	18.13%	3.01	0.13	55,900.38	0.26	55,941
LHD1	Dsl	40	1.20%	2.34	0.10	5,545.44	0.03	5,572
LHD1	Gas	40	1.21%	0.47	0.02	9,093.72	0.02	9,099
LHD2	Dsl	40	0.47%	0.94	0.04	2,424.53	0.01	2,435
LHD2	Gas	40	0.18%	0.06	0.00	1,562.87	0.00	1,564
MCY	Gas	40	0.59%	5.62	0.23	1,201.49	2.10	1,322
MDV	Dsl	40	0.41%	0.05	0.00	1,415.30	0.00	1,416
MDV	Elec	0	0.46%	0.00	0.00	0.00	0.00	0
MDV	Gas	40	11.17%	2.04	0.08	41,400.11	0.17	41,427
MH	Dsl	40	0.03%	0.58	0.02	258.13	0.00	264
MH	Gas	40	0.06%	0.05	0.00	858.48	0.00	859
Motor Coach	Dsl	40	0.02%	0.31	0.01	255.17	0.00	259
OBUS	Gas	40	0.05%	0.06	0.00	756.85	0.00	758
SBUS	Dsl	40	0.05%	0.56	0.02	460.86	0.00	467
SBUS	Gas	40	0.04%	0.04	0.00	276.79	0.00	277
T6 CAIRP Heavy	Dsl	40	0.01%	0.10	0.00	92.95	0.00	94
T6 CAIRP Small	Dsl	40	0.00%	0.00	0.00	0.06	0.00	0
T6 Instate Construction Heavy	Dsl	40	0.02%	0.25	0.01	202.95	0.00	206
T6 Instate Construction Small	Dsl	40	0.09%	0.88	0.04	805.44	0.00	815
T6 Instate Heavy	Dsl	40	0.28%	2.91	0.12	2,311.59	0.00	2,344
T6 Instate Small	Dsl	40	0.37%	3.54	0.15	3,213.57	0.00	3,253
T6 OOS Heavy	Dsl	40	0.01%	0.07	0.00	61.16	0.00	62
T6 OOS Small	Dsl	40	0.00%	0.01	0.00	10.69	0.00	11
T6 Public	Dsl	40	0.07%	0.60	0.03	596.40	0.00	603
T6 Utility	Dsl	40	0.00%	0.02	0.00	33.07	0.00	33
T6TS	Gas	40	0.23%	0.18	0.01	3,502.69	0.01	3,505
T7 CAIRP	Dsl	40	0.16%	2.96	0.12	1,699.30	0.00	1,732
T7 CAIRP Construction	Dsl	40	0.02%	0.29	0.01	181.38	0.00	185
T7 NNOOS	Dsl	40	0.20%	3.29	0.14	2,071.56	0.00	2,108
T7 NOOS	Dsl	40	0.06%	1.16	0.05	665.38	0.00	678
T7 Other Port	Dsl	40	0.02%	0.35	0.01	194.66	0.00	198
T7 POAK	Dsl	40	0.16%	3.28	0.14	1,820.01	0.00	1,856
T7 Public	Dsl	40	0.07%	1.23	0.05	911.33	0.00	925
T7 Single	Dsl	40	0.08%	1.33	0.06	1,102.12	0.00	1,117
T7 Single Construction	Dsl	40	0.04%	0.60	0.02	491.40	0.00	498
T7 SWCV	Dsl	40	0.00%	0.36	0.01	166.58	0.00	171

**Year 2040**

**GHG Emissions: Project**

Based on EMFAC2017, Webdata - Project Level Analysis, <https://arb.ca.gov/emfac/project-analysis>. Marin County - San Francisco Bay Area Air Basin (SFBAAB).

Uses 40 mph running exhaust emissions rates based on statewide average, as cited in the CalEEMod 2016 User's Guide.

N2O emissions were calculated using an off-model adjustment provided by CARB in the 2014 Scoping Plan Update. The off-model adjustment uses a linear regression correlating N2O with NOx. (N2O = 0.0416 x NOx)

VMT Adjustments to adjust Daily to Annual			
	Daily	Annual	Percentage
City	3,352,369	1,163,272,201	90%
SOI	385,521	133,775,629	10%
<b>TOTAL</b>	<b>3,737,890</b>	<b>1,297,047,830</b>	<b>100%</b>

<sup>1</sup> Based on data provided Fehr & Peers.

<sup>2</sup> Adjusted Daily vehicles miles traveled (VMT) multiplied by 347 days/year to account for reduced traffic on weekends and holidays. This assumption is consistent with the California Air Resources Board's (CARB) methodology within the 2008 Climate Change Scoping Plan Measure Documentation Supplement.

					Emission year				
					Year 2040		N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>
					1,297,047,830	Year 2040	AR5 GWP	AR5 GWP	AR5 GWP
							265	1	28
Vehicle Type	Fuel Type	Speed*	Percent of VMT	NOx	N <sub>2</sub> O	CO <sub>2</sub> (Pavley)	CH <sub>4</sub>	CO <sub>2</sub> e w/ Pavley + LCFS	
T7 SWCV	NG	40	0.03%	0.10	0.00	724.04	0.51	739	
T7 Tractor	Dsl	40	0.30%	5.62	0.23	3,349.50	0.00	3,411	
T7 Tractor Construction	Dsl	40	0.03%	0.62	0.03	396.58	0.00	403	
T7 Utility	Dsl	40	0.00%	0.01	0.00	14.48	0.00	15	
T7IS	Gas	40	0.00%	0.06	0.00	37.99	0.00	39	
UBUS	Dsl	40	0.02%	0.06	0.00	316.00	0.01	317	
UBUS	Gas	40	0.04%	0.07	0.00	529.97	0.00	531	
UBUS	NG	40	0.01%	0.04	0.00	184.09	0.56	200	
			<b>100%</b>	<b>55.55</b>	<b>2.31</b>	<b>308,926</b>	<b>4.30</b>	<b>309,659</b>	
			<b>City</b>	<b>50</b>	<b>2</b>	<b>277,064</b>	<b>4</b>	<b>277,721</b>	
			<b>SOI</b>	<b>6</b>	<b>0</b>	<b>31,862</b>	<b>0</b>	<b>31,938</b>	







# EMFAC Off-Model Adjustment Factors to Account for the SAFE Vehicle Rule Part One and Part 2

CARB. 2019, November.

[https://ww3.arb.ca.gov/msei/emfac\\_off\\_model\\_adjustment\\_factors\\_final\\_draft.pdf?utm\\_medium=email&utm\\_source=govdelivery](https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf?utm_medium=email&utm_source=govdelivery)

CARB. 2020, June 26

[https://ww3.arb.ca.gov/msei/emfac\\_off\\_model\\_co2\\_adjustment\\_factors\\_06262020-final.pdf?utm\\_medium=email&utm\\_source=govdelivery](https://ww3.arb.ca.gov/msei/emfac_off_model_co2_adjustment_factors_06262020-final.pdf?utm_medium=email&utm_source=govdelivery)

Effects Post-Year 2020 Annual Emissions for LDA, LDT1, LDT2, and MDV only.

Year 2040 - EMFAC2017 Exhaust Adjustment Factors

	NOx	PM	CO	CO2
2040	101%	103%	103%	112%

Notes:

EMFAC2017 PL Emissions Rates are still accurate. However, the % of EV vehicles compared to the total population changes slightly  
3 % decrease in VMT from EVs.